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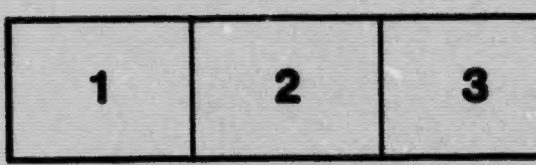
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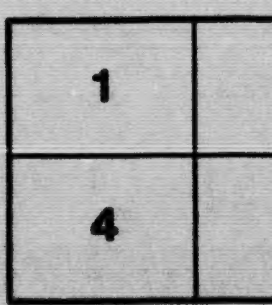
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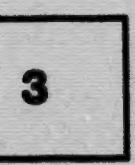
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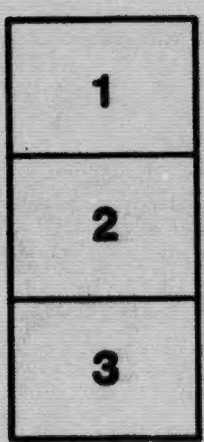
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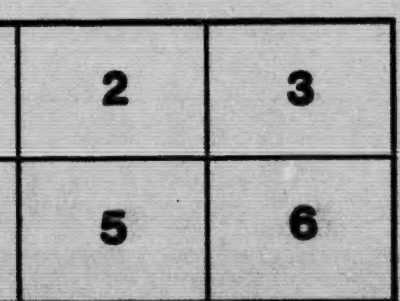
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A GUIDE BOOK

OF THE DOMINION TOUR OF THE
SECOND IMPERIAL PRESS CONFERENCE
JULY 25TH TO SEPTEMBER 15TH

1920

By
J. CASTELL HOPKINS
F.S.S., F.R.G.S.

FC
38
H66
1920

SCOTT



THE NEW PARLIAMENT BUILDING AT OTTAWA AS IT WILL APPEAR WHEN THE TOWER IS ERECTED. THE OLD BUILDING WAS DESTROYED BY FIRE ON FEB. 3-4, 1916

ITINERARY

OF

IMPERIAL PRESS CONFERENCE TOUR OF CANADA

1920

▽

STANDARD TIME

Mls.	Ar. Lv.	Place	Prov.	Day of Trip	First Section	Second Section	Time	Day of Week	Mth.	Day	Via	Transfers
	Ar.	Sydney	N.S.									
	Lv.	Sydney	"	1	6.30 p.m.	7.00 p.m.	"	"	"	27	Atl. S.S.	
288	Ar.	Halifax	"	2	8.00 a.m.	8.30 a.m.	"	Tue.	July	27	C.N.R.	
	Lv.	Halifax	"	3	6.00 a.m.	6.30 a.m.	"	Wed.	"	28	"	Trains to D.A.R.
73	Ar.	Kentville	"	"	9.00 a.m.	9.30 a.m.	"	Thur.	"	29	D.A.R.	
	Motor to Chipman Corner, Cunard St., Hamilton Corner, Starr's Point, Port Williams and											
20	Ar.	Wolfville	N.S.	3	11.30 a.m.		Atl.	Thur.	July	29	Motor	
	Lv.	Wolfville	"	"	12.00 noon		"	"	"	29	"	
3	Ar.	Grand Pre	"	"	1.00 p.m.		"	"	"	29	"	
	Lv.	Grand Pre	"	"	1.45 p.m.	2.15 p.m.	"	"	"	29	D.A.R.	
73	Ar.	Truro	"	"	5.45 p.m.	6.15 p.m.	"	"	"	29	"	Trains to C.N.R.
	Lv.	Truro	"	"	11.00 p.m.	11.30 p.m.	"	"	"	29	C.N.R.	
214	Ar.	St. John	N.B.	4	8.15 a.m.	8.45 a.m.	"	Fri.	"	30	"	
	Lv.	St. John	"	5	7.00 a.m.	7.30 a.m.	East.	Sat.	"	31	"	
80	Ar.	Fredericton	"	"	10.30 a.m.	11.00 a.m.	"	"	"	31	"	
	Lv.	Fredericton	"	"	3.00 p.m.	3.30 p.m.	"	"	"	31	"	
63	Ar.	Woodstock	"	"	5.30 p.m.	6.00 p.m.	"	"	"	31	"	
	Lv.	Woodstock	"	"	6.00 p.m.	6.30 p.m.	"	"	"	31	"	Trains to C.P.R.
83	Ar.	Cyr	"	"	10.00 p.m.	10.30 p.m.	"	"	"	31	C.P.R.	
	Lv.	Cyr	"	"	10.10 p.m.	10.40 p.m.	"	"	"	31	"	Trains to C.N.R.
276	Ar.	Quebec (Palais St.)	Que.	6	10.00 a.m.	10.30 a.m.	"	Sun.	Aug.	1	C.N.R.	
	Lv.	Quebec	"	7	8.30 a.m.	9.00 a.m.	"	Mon.	"	2	"	
82	Ar.	Grand Mere	"	"	12.00 noon	12.30 p.m.	"	"	"	2	"	
	Lv.	Grand Mere	"	"	2.30 p.m.	3.00 p.m.	"	"	"	2	"	
58	Ar.	Joliette	"	"	6.00 p.m.	6.30 p.m.	"	"	"	2	"	
	Lv.	Joliette	"	"	6.30 p.m.	7.00 p.m.	"	"	"	2	"	Trains to C.P.R.
62	Ar.	Montreal (Windsor St. Sta.)	"	"	9.05 p.m.	9.30 p.m.	"	"	"	2	C.P.R.	
	Lv.	Montreal	Que.	9	3.20 p.m.	3.30 p.m.	"	Wed.	"	4	"	
21	Ar.	St. Annes	"	"	3.50 p.m.	4.00 p.m.	"	"	"	4	"	
	Lv.	St. Annes	"	"	6.20 p.m.	6.40 p.m.	"	"	"	4	"	
91	Ar.	Ottawa	Ont.	"	8.40 p.m.	9.00 p.m.	"	"	"	4	"	
	Lv.	Ottawa	"	12	10.00 p.m.	10.20 p.m.	"	Sat.	"	7	"	
395	Ar.	Toronto (S.S. D'k)	"	13	8.00 a.m.	8.15 a.m.	"	Sun.	"	8	"	Trains to G.T.R.
	Lv.	Toronto	"	"	8.30 a.m.		"	"	"	8	C.S.L. Steamer	
36	Ar.	Queenston	"	"	11.00 a.m.		"	"	"	8	Electric Car	
	Lv.	Queenston	"	"	11.05 a.m.		"	"	"	8	"	
8	Ar.	Niagara Falls	"	"	12.45 p.m.		"	"	"	8	"	
	Lv.	Niagara Falls	"	14	9.00 a.m.	9.30 a.m.	"	Mon.	"	9	G.T.R.	
27	Ar.	Grimsby	"	"	10.00 a.m.	10.30 a.m.	"	"	"	9	"	
	Lv.	Grimsby	"	"	10.45 a.m.		"	"	"	9	Motor	
17	Ar.	Hamilton	"	"	11.15 a.m.		"	"	"	9	"	
	Lv.	Hamilton	"	"	3.00 p.m.		"	"	"	9	"	
39	Ar.	Toronto	"	"	5.30 p.m.		"	"	"	9	"	
	Lv.	Toronto	"	16	3.15 p.m.	4.00 p.m.	"	Wed.	"	11	G.T.R.	
46	Ar.	Guelph	"	"	5.00 p.m.	5.45 p.m.	"	"	"	11	"	
	Lv.	Guelph	"	17	7.15 a.m.	7.45 a.m.	"	Thurs.	"	12	"	
124	Ar.	Sarnia (Dock)	"	"	11.30 a.m.	12.00 noon	"	"	"	12	"	
	Lv.	Sarnia	"	"	4.00 p.m.		"	"	"	12	N.N.C. Steamer	
275	Ar.	Sault Ste. Marie	"	18	11.00 a.m.		"	Fri.	"	13	"	
	Lv.	Sault Ste. Marie	"	"	1.00 p.m.		"	"	"	13	"	
275	Ar.	Port Arthur	"	19	7.30 a.m.		"	Sat.	"	14	"	
	Lv.	Port Arthur	"	"	2.00 p.m.		"	"	"	14	Steamer	
5	Ar.	Fort William	"	"	5.00 p.m.		"	"	"	14	"	
	Lv.	Fort William	"	"	8.00 p.m.	8.30 p.m.	Cent.	"	"	14	C.P.R.	
426	Ar.	Winnipeg	Man.	20	9.00 a.m.	9.30 a.m.	"	Sun.	"	15	"	
	Lv.	Winnipeg	"	22	7.30 a.m.	8.00 a.m.	"	Tues.	"	17	"	
56	Ar.	Portage la Prairie	"	"	9.00 a.m.	9.30 a.m.	"	"	"	17	"	
	Lv.	Portage la Prairie	"	"	1.00 p.m.	1.30 p.m.	"	"	"	17	"	
50	Ar.	Carberry	"	"	2.30 p.m.	3.00 p.m.	"	"	"	17	"	
	Lv.	Carberry	"	"	2.45 p.m.		"	"	"	17	Motor	
28	Ar.	Brandon	"	"	6.30 p.m.		"	"	"	17	"	
	Lv.	Brandon	"	22	1.00 a.m.	1.30 a.m.	"	Wed.	"	18	C.P.R.	
131	Ar.	Broadview	"	"	5.45 a.m.	6.15 a.m.	"	"	"	18	"	
	Lv.	Broadview	"	"	4.55 a.m.	5.25 a.m.	Mount.	"	"	18	"	
90	Ar.	Regina	Sask.	"	8.30 a.m.	9.00 a.m.	"	"	"	18	"	
	Lv.	Regina	"	"	2.40 p.m.	3.10 p.m.	"	"	"	18	"	
43	Ar.	Moose Jaw	"	"	4.00 p.m.	4.30 p.m.	"	"	"	18	"	
	Lv.	Moose Jaw	"	"	7.00 p.m.	7.20 p.m.	"	"	"	18	"	
383	Ar.	Gleichen	"	24	7.30 a.m.	7.50 a.m.	"	Thurs.	"	19	"	
	Lv.	Gleichen	"	"	12.00 noon	12.30 p.m.	"	"	"	19	"	
52	Ar.	Calgary	"	"	2.00 p.m.	2.30 p.m.	"	"	"	19	"	

This schedule is subject to possible changes, which will be announced.

ITINERARY OF IMPERIAL PRESS CONFERENCE TOUR OF CANADA, 1920

▽

STANDARD TIME—*continued*

Mls.	Ar. Lv.	Place		Prop.	Day of first Trip	Section	Second Section	Time	Day of Week	Mth.	Day	Via	Transfers
	Lv.	Calgary	Alta.	25		10.30 a.m.		Mount.	Fri.	Aug.	20	Motor	
	Ar.	Ghost River	"	"		1.00 p.m.		"	"	"	20	"	
	Lv.	Ghost River	"	"		2.00 p.m.		"	"	"	20	"	
82	Ar.	Banff	"	"		6.00 p.m.		"	"	"	20	"	
	Lv.	Banff	"	27		See Note A		"		"	20	"	
35	Ar.	Lake Louise Sta.	"	"		"		"	Sun.	"	22	C.P.R.	
	Lv.	Lake Louise Sta.	"	"	7.00 a.m.	7.30 a.m.		"	"	"	22	"	
3	Ar.	Lake Louise Hotel	"	"	7.30 a.m.	8.00 a.m.		"	"	"	22	Track Motor	
	Lv.	Lake Louise Hotel	"	28		See Note B		"	"	"	22	"	
3	Ar.	Lake Louise Sta.	"	"		"		"	Mon.	"	23	"	
	Lv.	Lake Louise Sta.	"	"	8.00 a.m.	8.30 a.m.		"	"	"	23	"	
20	Ar.	Field	B.C.	"	9.30 a.m.	10.00 a.m.		"	"	"	23	C.P.R.	
	Lv.	Field	"	"	8.45 a.m.	9.15 a.m.	Pac.	"	"	"	23	"	
109	Ar.	Lake Windermere	"	"	1.00 p.m.	1.30 p.m.	"	"	"	"	23	"	
	Lv.	Lake Windermere	"	"	4.30 p.m.	5.00 p.m.	"	"	"	"	23	"	
277	Ar.	Vernon	"	29	5.30 a.m.	6.00 a.m.	"	"	Tues.	"	24	"	
		Motor through Okanagan Valley and return											
	Lv.	Vernon	B.C.	29	2.30 p.m.	2.40 p.m.	"	"	"	"	24	"	
46	Ar.	Sicamous	"	"	4.30 p.m.	4.50 p.m.	"	"	"	"	24	"	
	Lv.	Sicamous	"	"	4.40 p.m.	5.00 p.m.	"	"	"	"	24	"	
235	Ar.	Vancouver	"	30	7.30 a.m.	7.40 a.m.	"	"	"	"	25	"	
	Lv.	Vancouver	"	32		10.00 a.m.	"	"	Wed.	"	27	"	
83	Ar.	Victoria	"	"		2.30 p.m.	"	"	Fri.	"	27	C.P. Steamer	
	Lv.	Victoria	"	34	2.15 p.m.	11.45 p.m.	"	"	"	"	27	"	
83	Ar.	Vancouver	"	"	6.45 p.m.	(8)7.00 a.m.	"	"	Sun.	"	29	"	
	Lv.	Vancouver	"	35	8.00 a.m.	8.30 a.m.	"	"	Mon.	"	30	"	
261	Ar.	Kamloops	"	"	7.15 p.m.	7.45 p.m.	"	"	"	"	30	C.N.R.	
	Lv.	Kamloops	"	"	9.15 p.m.	9.45 p.m.	"	"	"	"	30	"	
276	Ar.	Jasper	Alta.	36	10.00 a.m.	10.30 a.m.	"	"	"	"	30	"	
	Lv.	Jasper	"	"	7.00 p.m.	7.30 p.m.	"	"	Tues.	"	31	"	
241	Ar.	Edmonton	"	"	9.00 a.m.	9.30 a.m.	Mount.	Wed.	Sept.	1	"	Trains to G.T.P.	
	Lv.	Edmonton	"	38	9.15 a.m.	9.45 a.m.	"	Thurs.	"	2	G.T.P.		
127	Ar.	Wainwright	"	"	1.25 p.m.	1.55 p.m.	"	"	"	2	"		
	Lv.	Wainwright	"	"	9.00 p.m.	9.30 p.m.	"	"	"	2	"		
200	Ar.	Saskatoon	Sask.	39	3.50 a.m.	4.20 a.m.	"	"	Fri.	3	"	Trains to C.N.R.	
	Lv.	Saskatoon	"	"	4.30 a.m.	5.00 a.m.	"	"	"	3	C.N.R.		
87	Ar.	Prince Albert	"	"	7.30 a.m.	8.00 a.m.	"	"	"	3	"		
	Lv.	Prince Albert	"	"	11.30 a.m.	12.00 noon	"	"	"	3	"		
87	Ar.	Saskatoon	"	"	3.30 p.m.	4.00 p.m.	"	"	"	3	"		
	Lv.	Saskatoon	"	"	8.00 p.m.	8.30 p.m.	"	"	"	3	"	Trains to G.T.P.	
472	Ar.	Winnipeg	Man.	40	12.30 p.m.	1.00 p.m.	Cen.	Sat.	"	4	G.T.P.	Trains to C.N.R.	
	Lv.	Winnipeg	"	"	10.00 p.m.	10.30 p.m.	"	"	"	4	C.N.R.	Trains to T.N.O.	
777	Ar.	Cochrane	Ont.	"	3.00 a.m.	3.30 a.m.	East	Mon.	"	6	T.N.O.		
	Lv.	Cochrane	"	"	3.20 a.m.	3.50 a.m.	"	"	"	6	"		
61	Ar.	Timmins	"	"	6.30 a.m.	7.00 a.m.	"	"	"	6	"		
	Lv.	Timmins	"	"	11.00 a.m.	11.30 a.m.	"	"	"	6	"		
145	Ar.	New Liskeard	"	"	4.45 p.m.	5.15 p.m.	"	"	"	6	"		
	Lv.	New Liskeard	"	"	7.45 p.m.	8.15 p.m.	"	"	"	6	"		
10	Ar.	Cobalt	"	"	8.15 p.m.	8.45 p.m.	"	"	"	6	"		
	Lv.	Cobalt	"	"	10.15 p.m.	10.45 p.m.	"	"	"	6	"		
104	Ar.	North Bay	"	43	2.30 a.m.	3.00 a.m.	"	"	"	6	"		
	Lv.	North Bay	"	"	3.00 a.m.	3.30 a.m.	"	"	Tues.	7	"	Trains to G.T.R.	
81	Ar.	Huntsville	"	"	6.30 a.m.	7.00 a.m.	"	"	"	7	G.T.R.		
	Lv.	Huntsville	"	"		9.00 a.m.	"	"	"	7	"		
25	Ar.	Bigwin Inn	"	"		11.30 a.m.	"	"	"	7	L. of B. Steamer		
	Lv.	Bigwin Inn	"	"		4.00 p.m.	"	"	"	7	"		
25	Ar.	Huntsville	"	"		6.30 p.m.	"	"	"	7	"		
	Lv.	Huntsville	"	44	12.30 a.m.	1.00 a.m.	"	"	"	7	"		
146	Ar.	Toronto (Exhibit'n)	"	"	6.30 a.m.	7.00 a.m.	"	"	Wed.	8	G.T.R.		
	Lv.	Toronto	"	45	12.20 a.m.	12.50 a.m.	"	"	"	8	"		
220	Ar.	Prescott	"	"	7.00 a.m.	7.30 a.m.	"	"	Thurs.	9	"		
	Lv.	Prescott	"	"		9.00 a.m.	"	"	"	9	"	Trains to C.P.R for C.S.L. Dock	
120	Ar.	Montreal	Que.	"		5.15 p.m.	"	"	"	9	C.S.L. Steamer		
	Lv.	Montreal	"	"		6.00 p.m.	"	"	"	9	"		
180	Ar.	Quebec	"	46		5.00 a.m.	"	"	Fri.	10	"		

8,589 Total mileage of tour.

Note A—Passengers required to be on trains by 12 midnight Saturday. Trains will be moved to Lake Louise sometime between midnight and 6 a.m.

Note B—Passengers sleeping at hotel must allow sufficient time to be at Lake Louise Station for departure of their sections.

This schedule is subject to possible changes, which will be announced.

C · A · N · A · D · A

E A S T · A N D · W E S T

A Great Country and an Inspiring History

To the casual visitor Canada appeals as a country of vast distances, great bodies of water, wonderful rolling prairies, scattered population and a few great centres, fertility of resources and richness of soil, a marked industrial development. To the careful tourist, anxious to estimate a great region of the earth at its true value, Canada presents a picture of half-a-continent under control of only 8,000,000 people, of enormous possibilities in wealth and progress and expansion, of the greatest undeveloped spaces of fertile soil left in the world, of provincial divisions with areas larger than those of great European nations and a total national area of 3,729,665 square miles or more than that of the United States and nearly equal to the Continent of Europe, of a people marked by virility and stamped with the impress of qualities which combine the lightness and brightness and vibrant patriotism of the French race with the commercial spirit, the industrious effort, the unemotional patriotism of the British peoples.

To the student of history and human nature, Canada presents one of the most interesting problems and attractive records in the world—memories of pioneer efforts in the New World which involved the burning patriotism of the United Empire Loyalist, the fighting fidelity to a great faith of the Jesuit fathers, the stern, cruel but brave and devoted love of the Indian for the home of his wandering tribes, the vivid strength of the French settlers as they clung to their hold upon the outposts and the central paths of a continent against the incoming wave of a great colonizing people.

To all travellers no story of a slowly-evolving national life can be more attractive than the record of Canada as it grew from a congeries of tiny settlements in the forests of Upper Canada, by the Atlantic Coast, or up the mighty waterway of the St. Lawrence, into far-flung and separated colonies with a British or French spirit, as the case might be; which gradually drew into itself a native love of soil and developed during a century into a passionate love of country which yet finds room today for the old British spirit and a new Imperial concept; which expanded its constitution from that of colonies into a federal union, blazing the pathway to similar institutions in Australia and South Africa. Canada pictures to the world today the almost miraculous preservation of British institutions and sentiment, a national spirit and patriotism, during more than a hundred years against the apparently overwhelming pressure and influence of a great people who grew upon their 3,000 miles of border from 5 to 100 millions with somewhat similar social customs, democratic ideals and language, with similar commercial practices and interests and, always, with a vastly greater wealth and population and a more aggressive ambition. Its people in this period overcame all difficulties and carried practical power and sovereignty from a narrow fringe along the great lakes, or the St. Lawrence, or the Atlantic into possession, government and partial development of a vast country stretching 3,000 miles from the Atlantic to the Pacific and holding the gateway of an almost illimitable promise within its grasp.

The Area, Waterpowers and Population of Canada

In the 3,729,665 square miles of Canada's area there are 125,775 square miles of water; in the great system of the St. Lawrence, with its 1,900 miles drainage and including the largest of the fresh water formations in the world; in the Nelson flowing through 9,600 miles of mountain ranges and fertile prairie into the stormy waters of Hudson Bay; in the Saskatchewan, 1,200 miles long, and the Churchill, 1,000 miles long, with similar mountainous beginnings and the same great semi-inland sea at its mouth; in the Yukon of the far north and running partly through United States territory, with the Columbia partly in British Columbia and partly south of the line, and in the Mackenzie, running 2,525 miles into the Arctic Ocean with the

Peace flowing 1,065 miles to the same outlet; in these great systems, with 110 lesser but still considerable rivers tributary to or a part of them, are to be found every type of scenery, natural character, physical environment.

The Great Lakes with their 95,105 square miles, as they branch out from the St. Lawrence in five immense bodies of water and one small one, are about equally divided between United States and Canadian territory with the mighty volume of Lake Superior constituting the largest body of fresh water in the world. In this vast variety of rivers, with lakes numbering over 218, there is probably the greatest undeveloped electrical water-power possessed by any country—estimated at 17,764,000 horse-power.

The estimated population in 1918 was 8,593,000, compared with 7,200,000 in 1911, 5,371,000 in 1901 and 3,689,257 in 1871. The people of Canada were, in 1911, divided into 3,925,679 in rural districts and 3,280,964 in urban centres—an increase of 574,878, or 17.16 per cent., in rural districts since 1901 and of 1,258,645, or 62.25 per cent., in urban centres. The war caused a change in this ratio and the Prairie Provinces, in 1916, showed a five-years' increase of 29 per cent. urban and 27 per cent. rural. In 1911, of foreign-born there were 167,441 from what, a few years later, were enemy countries, 508,483 from Allied countries, including 303,680 from the United States, while 76,808 came from what were then called neutral countries; of the total of 752,732, 344,557, or 46 per cent., were naturalized. By origin, 1,823,150 were English, 1,050,384 Irish, 997,880 Scotch, 2,054,890 French and the balance scattering; the proportion born of British descent was 59 per cent. in 1881, 57 per cent. in 1901 and 54 per cent. in 1911.

According to occupation there were (census 1911) 933,735 engaged in agriculture, 491,342 in manufacturing, 283,087 in trade and merchandising, 217,544 in transportation, 246,201 in building trades; of the total population 2,723,634 were engaged in some form of gainful occupation or work. As to the total immigration to Canada in 1901-19 those from Great Britain numbered 1,177,856, from the United States 1,250,806, and from other foreign countries 838,687.

The Climate of the Half Continent Called Canada

A word must be said as to the diversified climatic conditions of Canada. The Atlantic provinces come under the conflicting influence of the Gulf Stream and the Arctic current and their latitude being about that of southern Europe, the climate is temperate though with somewhat colder weather in winter and spring. Touches of the English climate and passing views of gigantic icebergs are contradictory elements of the eastern coasts; Prince Edward Island, as the garden of the Gulf of St. Lawrence, and the Annapolis Valley as the home of fruit production, and King's County, Nova Scotia, as the Land of Evangeline, are illustrative of productive power and scenic beauty.

The vast area of Quebec, stretching from the Gulf of St. Lawrence, across a continent to the bleak forests of Labrador, comprises every kind of American climate from the clear sun-shot cold of winter to the productive heat of a summer day and the delightful coolness of a summer evening. There is much the same climatic variety in Ontario, where the fruit of the Niagara region and the grapes of the St. Lawrence Valley illustrate the character of the summer season, and the invigorating cold of Cobalt in winter compares with the James Bay climate of Northern Quebec. In the Prairie Provinces, as the great plains sweep from Manitoba to the mountains, the brightness, clearness, dryness and pureness of the atmosphere are famous; the occasionally intense heat and severe cold serve as a foil and contrast to the usual health-giving and bracing weather. The warm chinook winds coming through passes in the Rocky Mountains have the same influence upon Alberta as it lies at the base of the great range as the Gulf Stream has upon the Maritime Provinces.

In the far northern part of the great prairie region a new Canada of quite reasonable climatic conditions is opening out for development with a Peace River country of noble waterways and rich resource running north of Alberta and into British Columbia, and a continuous trek of pioneers passing from Edmonton to the new Land of Promise. British Columbia merges from the inevitable cold of its lofty mountain tops into the sunny warmth of its Pacific slopes and produces at Vancouver, or in the island of that name, where the capital rests, a climate so like that of England as to draw English settlers there as by a magnet.

As a whole, Canada is essentially a bright country. It has more sunshine than Europe. It is a land of bright skies, and when summer comes, with its long, sunny

days, the grains ripen quickly. On the western prairie there are, on the average, two hours more of sunlight each day during summer than in England, where there is sunshine only for one-quarter to a little over one-third of the time; England's highest average is, in fact, Canada's lowest. One of the great influences on the climate of Canada is the immense area of inland waters.

The Farms and Farmers of Canada

Agriculture is often called the chief interest and industry of Canada. Out of a total acreage of 300,000,000 fit for farming only 70,000,000 acres are under cultivation; yet the 1,000,000 farms of the Dominion in 1918 realized $1,367,909,970 for their field crops, compared with $638,580,300 in 1914 and, during the four war-years, the total product was valued at $4,863,000,000. War prices accounted for a part of this increase but the actual acreage had also increased from 54 millions in 1915 to 70 millions in 1918. Similarly, the values of live-stock grew in these years from $726,000,000 to $1,326,000,000. In 1918, as a matter of fact, the farmers of Canada received from their field crops and farm animals exported, sold or slaughtered, from wool and cheese and butter, from milk, fruits, vegetables, poultry and eggs, a total of over $1,800,000,000 and possessed a capital wealth in live-stock, farm-lands, buildings and implements of $5,450,000,000. During the war-years they had exported, chiefly to Great Britain, a total of $2,055,000,000 in agricultural products and animals or their produce. The fruit farms of Ontario, Nova Scotia and the rich valleys of British Columbia are also famous.

All over this half of a continent the farmer is realizing the immense possibilities of his occupation. Between 1908-17 the average production of wheat to the acre was 19 bushels, of oats 35, of barley 27, and of potatoes 150 bushels. Alfalfa and flax are crops receiving much attention in the last two years; the Marquis seed wheat and other famous varieties such as Red Fife and Prelude and the new Ruby have obtained every international prize which United States agricultural bodies can award; dairying is an increasing factor and totals about $400,000,000 in yearly product; 21 Dominion experimental farms, in all the provinces, teach practical lessons in farming and production and are ably seconded by such institutions as the agricultural colleges of Ontario, Manitoba and Nova Scotia, which are provincial institutions, and those of Quebec, Saskatchewan, Alberta and British Columbia, which are university adjuncts, together with the excellent agricultural schools of Alberta at Olds and other points; as to elevators for receiving and storing grain, there are 3,670 in Ontario and Western Canada with a capacity of 179,000,000 bushels; there are also Government-owned terminal elevators at Port Arthur, Saskatoon, Moose Jaw, Calgary and Vancouver. The number of live-stock in Canada in 1918 was as follows:—3,667,369 horses, 10,084,011 head of cattle, 3,052,748 sheep and 4,040,070 swine. The increase in six years was over 7,000,000 animals.

Forests and Forestry; the Great Pulpwood Industry

The great forests of Canada have suffered much in the past century from fire and exploitation. The central line of the forest-belt was scientifically described by the late Dr. Robert Bell, an expert of his day, as starting near the Straits of Belle Isle on the Atlantic coast, running southwest nearly to James Bay, thence northwest to the border of Alaska and the mouth of the Mackenzie River—a total distance of 3,700 miles, with an average breadth of 600 miles and an approximate area of 2,500,000 square miles. Estimates vary, however, and Dr. B. E. Fernow, Professor of Forestry, Toronto University, puts the area at 1,000 million acres with 200,000,000 acres of actual merchantable timber; R. H. Campbell, Dominion Director of Forestry, in 1912 estimated 500 million acres of forest land of which one-half was covered with merchantable timber.

The increasing scarcity and demand for timber in the United States are making this resource of special value and importance with Canada now third in available supplies—Russia and the United States being the other two countries. There are 31 Forest Reserves in Canada administered by the Dominion Government with an area of 35,936 square miles and 14 National Parks with an area of 8,948 square miles; the Forestry Department at Ottawa promotes exploration, fire protection, forest management, tree planting and scientific investigation of wood products.

The cut of lumber in 1917 was 4,151,703,000 feet, B.M., valued at $83,655,000; there were in 1918, 2,879 operating concerns with a capital of $140,266,000, wages

of $34,412,000 and a product of $115,177,000. The pulp-wood industry is of ever-increasing importance. According to the Commission of Conservation the total resources of the Dominion in this respect are 1,033,370,000 cords but much of this is inaccessible at present for commercial purposes; there are 91 companies engaged in the manufacture of pulp or paper with a combined capital of $240,000,000 and an output of $85,000,000—with exports of $71,755,000 in 1918 and increasingly high prices for paper of every description. The by-products of Canadian lumber include bark products and tanning extracts, maple syrup and sugar and vinegar, grain alcohol and various chemicals, pine sawdust and shavings, hardwood distillations of charcoal, methyl alcohol, acetate of lime, acetone, acetic acid and wood-tar, coniferous wood distillations which produce resin, turpentine, pine oil, etc.

The Mines and Minerals of Canada

Underlying the mighty mountain ranges of Canada are untold gold and silver and copper and coal and other precious minerals; British Columbia, with its tiny population, has already taken away $630,000,000 and has only scratched its rugged soil; the Yukon has produced $160,000,000 worth of gold and the Cobalt region $170,000,000 worth of silver while that of Porcupine has produced $40,000,000 worth of gold and the famous Hollinger Mine has only commenced producing; in 20 years the total mineral production of Canada has grown from $28,485,023 to $189,646,821 in 1917 and in 1918 it was 20 millions more. The possibilities of future production are boundless with many new discoveries every year.

Bituminous coal exists in vast quantities in Nova Scotia. Under the soil of the Western Provinces and British Columbia there are estimated to be 1,360,000,000,000 tons of anthracite, bituminous and lignite coal; in the far northern Peace River there are untold possibilities in 1,000 square miles of tar sands which promise petroleum and asphalt; in the Hudson Bay region of Manitoba all kinds of minerals are coming to light day by day; in the Sudbury country around Lake Superior, there is nickel to supply the world and all through the northern parts of Quebec and Ontario—illustrated by Cobalt and Porcupine with their dividends of over $10,000,000 a year—time promises to develop many similar camps. Amongst the more valuable lesser metals produced in growing quantities are antimony, arsenic, asbestos, barytes, molybdenite, platinum, corrundum, feldspar, mica and all kinds of building stone, clay-products, natural gas, peat, zinc, lead, gypsum, graphite and structural cements, salt, tungsten, talc, bituminous shale, etc.

No coal, as yet, has been discovered in Ontario, but electric power is taking its place to an ever-increasing degree; iron-ore deposits have been located in British Columbia with 12,000,000 tons as the estimated product in Vancouver and Texada Islands, at points in Alberta, and throughout Nova Scotia, in New Brunswick and along the Ontario shores of Lake Superior, and in parts of Quebec. Of iron blast-furnaces, Canada has 19 with a daily capacity of 4,835 tons and with a varying number in yearly operation; they include the Dominion Iron and Steel Co., Sydney, N.S., the Nova Scotia Steel & Coal Co., New Glasgow, N.S., the Steel Company of Canada at Hamilton, the Algoma Steel Corporation, Sault Ste. Marie, the Atikokan Iron Co., Port Arthur.

Canadian Industries and Manufacturing Development

The industrial evolution of Canada is a very interesting study in natural conditions, geographical difficulties, international competition, tariff history, individual enterprise and final success. Primarily an agricultural community of small and scattered population, with, prior to Confederation, tariffs between its several provinces, with new provinces in later years separated by great distances with a large and populous nation to the south proud of its manufacturing progress and specialized industries, Canada had no easy path to victory in this connection. The census of 1890 showed a manufactured product of $368,696,723; that of 1910 had increased to $1,165,975,639; that of 1917 showed figures of $3,015,506,869; the export of war manufactures and munitions, alone, in 1916-18 was $948,000,000. In the four war years, taken separately, the total export of manufactured goods was as follows: 1914-15, $85,539,501; 1915-16, $408,026,574; 1916-17, $703,057,168; 1917-18, $636,602,516. In 1890 the capital

invested in manufactures was $331,635,499, in 1910 it was $1,247,583,609, in 1917 it was $2,386,649,727. By provinces and periods the growth of industrial production was as follows:

Provinces	1900	1915	1917
	$	$	$
Alberta	1,313,320	29,416,221	71,669,423
British Columbia	19,447,778	72,321,972	171,425,616
Manitoba	12,927,439	60,481,446	122,804,881
New Brunswick	20,972,470	37,303,900	62,417,466
Nova Scotia	23,592,513	69,345,819	176,369,025
Ontario	241,533,486	715,531,839	1,533,738,655
Prince Edward Island	2,326,708	2,586,823	5,517,910
Quebec	158,287,994	381,203,999	830,614,029
Saskatchewan	651,667	13,355,206	40,657,746
Yukon	.....	.....	363,189

As to the nature of these industries, it may be stated that food products represented in 1917 a total of $754,637,940; textiles $265,448,565; iron and steel $400,385,086; other metals and metal products $171,650,905; timber and lumber $287,982,105; paper and printing, $85,977,658; chemicals and allied products, $133,618,658; vehicles for land transportation, $197,488,770.

Trade and Commerce of Canada

For its population, the trade of Canada is the greatest in the world. It is more than double that of Great Britain per capita and three times that of the United States. Its development was comparatively slow from Confederation in 1868 until 1898—$119,791,879 to $285,836,707; after that it rose steadily to $1,073,894,368 in 1914 and in the war-years leaped upward to a total of $2,548,713,538 in the fiscal year 1918, and $2,185,194,620 in 1919. For the calendar year 1919 the figures were 2,236 millions, or about $280 per head of the population. Between 1868 and 1893 the balance of trade was usually against the Dominion; in 1914 it was favourable, but in 1904-14, the current changed and went against Canada in an ever-increasing volume. During the four years 1911-14 the imports were $833,899,402 more than the exports; in 1915-1918 the exports were $1,370,111,542 more than the imports. The great bulk of this trade has always been divided between the United Kingdom and the United States. In the ten-year periods it was as follows:

Year (March 31st)	Exports to U.K.	Exports to U.S.	Imports from U.K.	Imports from U.S
1868	$ 17,905,808	$ 22,387,846	$ 37,617,325	$ 22,660,132
1878	35,861,110	22,131,343	37,252,769	48,002,875
1888	33,648,284	37,323,161	39,167,644	46,440,296
1898	93,065,019	34,361,795	32,043,461	74,824,923
1908	126,194,124	90,814,871	94,417,314	204,648,885
1918	861,073,399	440,811,400	81,324,283	791,906,125

Canadian trade with the British Empire in 1918 was $128,055,371 of imports and $905,026,930 of exports. In 1871 imports from Great Britain were 57.58 per cent. of Canadian imports, in 1881 47.39 per cent. in 1891 37.67 per cent, in 1901 24.01 per cent, in 1911 24.34 per cent, in 1918 8.44 per cent. There were corresponding increases in imports from the United States while in exports the percentages increased to Great Britain in relatively the same measure as the imports therefrom decreased. According to the main lines of production in Canada, its exports were as follows in recent years:

Agricultural

	To U.K.	To U.S.	To other Countries
1911	$ 61,393,720	$ 10,385,705	$ 10,821,859
1914	146,230,104	32,506,548	19,483,377
1915	95,834,460	19,405,521	19,506,069
1916	196,077,876	18,620,236	34,963,082
1917	266,210,322	45,138,610	62,064,769
1918	403,456,560	101,877,411	62,379,613

Animals.			
1911	40,636,575	10,063,344	1,544,055
1914	26,735,114	24,728,798	1,885,207
1915	38,222,698	34,186,056	1,981,980
1916	67,821,789	29,051,195	6,009,292
1917	93,299,158	28,575,365	5,920,945
1918	112,196,873	48,078,407	12,467,801
Manufacturing.			
1911	6,973,820	16,524,005	11,785,293
1914	8,583,540	30,391,764	18,468,148
1915	24,848,359	42,164,753	18,526,389
1916	148,477,303	58,202,141	35,355,554
1917	339,013,448	91,990,586	46,395,642
1918	300,715,681	151,883,178	184,053,657

Banks and Banking in Canada

The history of the banking institutions which the visitor in Canada so constantly encounters—20 banks with over 4,200 branches—is an interesting study. In its completed form it is a combination of British systems administered with a caution as to fundamental matters which is very British, and with an energy and readiness to assimilate new ideas and methods of ordinary operation which is typically American. When the provinces came together in 1867, there were 18 banks in Canada—the first was the Bank of Montreal, established in 1817, and the second, the Quebec Bank, formed in 1818; in 1902 there were 36 banks with 747 branches; in 1919, after many changes, due in part to a few small failures but in the main to amalgamations, there were 18 banks, with 4,300 branches.

There are several important differences between the American and Canadian systems. The chief is probably the Branch plan under which the vast distances and transportation difficulties of earlier days in Canada lost much of their effect upon isolated centres because of the easy flow of money from the head offices to the sections where money was most needed; similarly the branch system has made the financing of the annual movement of Canadian crops thousands of miles by land and water, a comparatively easy matter. So with the matter of failures. In the United States, where there are thousands of small national or private banks independent of each other, failures have been very numerous at every financial crisis; in Canada most of the crises of the past century passed without a single failure. In the United States, also, money may be plentiful in the east and very hard to get in the west, ar o on; in Canada, the flexibility of the banking system provides admirably for all sections and for individual protection and convenience.

Under the Canadian system the charters of all banks expire simultaneously every ten years and require to be, and always have been, specifically renewed. Banks are empowered to issue circulating notes to the extent of their unimpaired paid-up capital and these, in 1880, were made a first lien on all assets. In 1890 the banks were required to create a guarantee fund of 5 per cent. on their circulation to be maintained unimpaired for redemption of notes of any single bank which might fail and be unable to redeem its notes within 60 days. These notes are not secured by special deposit of securities with the Government as in the United States, but are based upon the general assets of the institution concerned; notes under $5.00 are issued by the Government. There are clearing houses in all the chief cities and centres—the first was formed in Halifax in 1887. The total in 1902 was $1,871,061,725; in 1918 it was $13,763,803,755 and in 1919 $16,709,598,895. The banks of Canada took a conspicuous and at the same time a cautious part in the war; they did much in policy and in the maintenance of public confidence to give Canada financial stability and thus enable the Government to do its part; they lent large sums of money to Great Britain for purposes of trade. How they prospered in that period may be seen in the following table:

	1914	1919
Gold and coin	$ 62,659,688	$ 80,088,103
Dominion notes	138,056,339	172,964,172
Loans in Canada	854,546,031	1,207,109,046
Total assets	1,555,556,815	2,965,373,675
Reserve fund	113,070,859	124,712,670
Circulation	105,969,755	232,486,736
Public deposits	1,012,739,990	1,841,478,895
Total liabilities	1,314,646,254	2,706,715,918

Transportation Interests of Canada

The history of Canadian railways is one of the most interesting records in the world. The overcoming of construction difficulties, the conquest of geographical and physical obstacles, the victory over elements of financial doubt and even disaster, the success of business brain and individual enterprise over every kind of opposition, stamp the whole story with an interest of rare strength. A tiny population, spread thinly over half a continent, saw its railway mileage increase from 2,260 in 1868—chiefly the Grand Trunk and the Intercolonial—to 6 226 in 1878, 12,163 in 1888, 16,870 in 1898, 22,966 in 1908 and 38,879 in 1918. The total investment of money in these lines grew from $257,035, 188 in 1868 to $1,999,880,494 in 1918; the areas of land granted by Dominion and Provincial Governments to aid construction up to 1916 totalled 55,740,249 acres, with $222,157,523 in cash and loans; the freight hauled in the year of June 30th, 1904, was 48,097,519 tons, in 1914, before the war, it was 101,393,989 tons, in 1918 it was 127,543,687; similarly, the passengers carried increased from 23,640,765 in 1904 to 46,702,280 in 1914 and 50,737,294 in 1918.

Up to 1916 the total cost of construction of the Government railways, chiefly the Intercolonial and the National Transcontinental, was $366,657,792, the working expenses to date $237,703,772, and the revenues $224,854,538. The large mileage of the Canadian Northern system has since been added to the Canadian National and the Government has entered into an agreement to purchase the lines of the Grand Trunk system.

The Grand Trunk has sixty-five years of public service to its credit. It is not only Canada's pioneer railway, but stands prominent among the pioneer railways of America. Including its Grand Trunk Pacific mileage in Western Canada, it has more than 8,000 miles of line. It links up the principal cities of Canada and connects them in turn with many of the great producing centres of the United States. In the Province of Ontario alone the company has 3,000 miles of railway.

The Canadian Pacific Railway has woven its development into almost every phase of Canadian development and politics from 1872 to the present; the Grand Trunk Pacific and National Transcontinental—the latter a Government link from Moncton to Winnipeg—in the past decade, and the Canadian Northern, or C.N.R. during the years of the present century, have contributed many interesting chapters to the personal and progressive annals of this new country.

Many books could be written about the Canadian Pacific Railway without exhausting its human interest or doing more than justice to its economic importance; all that can be said here is that up to the creation of the vast and not yet fully-organized system of Canadian Government Railways, it was the greatest single system in the world. It is still one of the most prosperous and one of the best managed,

In 1882 it had a mileage of 1,730, in 1898 of 7,537, and on December 31st, 1919, of 13,792 with, in addition, 4,853 miles in the United States, and steamship lines on many lakes and two oceans. In 1909 its gross earnings were $76,313,321 and working expenses $53,357,748; in 1919 they were $176,929,060 and $142,996,024 respectively. At the end of 1919 the C.P.R. had 2,255 locomotives, 2,658 passenger cars, 87,681 freight cars and 8,484 others. The C.N.R., as an independent transcontinental line, closed its career in 1918 with 9,396 as the total average of mileage operated; with gross earnings of $43,495,076 and expenses of $31,349,408, assets of $592,173,428, and a stated surplus over liabilities of $34,842,073.

The Canadian Government, realizing how much the future trade prosperity of Canada depended upon her being able to carry her own products overseas in Canadian-built and Canadian-owned ships, decided last year to build a fleet of Canadian merchant vessels in Canadian yards to be operated in connection with its national railway system and to serve as a feeder to its lines. The shipbuilding programme up to the end of March, 1920, provides for the construction of 63 cargo vessels, having a total dead-weight carrying capacity of 380,615 gross tons. These vessels, as they are completed by the builders, are turned over for operation to the Canadian Government Merchant Marine Limited, which is a subsidiary of the Canadian National Railways. In the month of March, 1920, that company had in service 24 vessels with a dead-weight capacity of 122,875 gross tons, and by the end of June, according to the latest advices received from the builders in respect to delivery, there should be 46 boats in service with a total carrying capacity of 248,765 dead-weight tons.

Since the spring of 1919, when the "Canadian Voyageur," the first vessel of Canada's fleet of commerce carriers, was turned over for inspection, the Govern-

ment service has maintained regular sailings between Canada and Liverpool, Canada and Glasgow, Canada and London, Canada and Cuba, Canada and Jamaica and Havana, Canada and Barbados, Trinidad and Demerara, Canada and Pernambuco, Rio de Janeiro, Santos and Buenos Aires; Canada and Australia and New Zealand from Pacific ports; and on the opening of the St. Lawrence navigation this year, regular services were established from Montreal to St. John's, N.F.

Electric Railways, Motors, Canals and Shipping

As to electric railways in Canada, conditions show great possibilities of development with, in 1916, an operated mileage of 1,673, passengers numbering 380 millions and 1,936,674 tons of freight carried; gross earnings of $27,416,285 and working expenses of $18,099,906. Tremendous expansion in motor vehicles is a sign of the times in Canada with 69,598 registered in 1914, and 123,464 in 1916; over 200,000 were reported in 1918 and the estimate for 1919 is 320,000 passenger cars and motor trucks, with an investment of $300,000,000. Express companies in 1916 showed an operating mileage of 41,994, expenses of $12,087,210, a total financial business of $56,500,851, and total earnings of $12,874,902.

The canal systems of Canada number six and consist of (1) the canals between Port Arthur or Fort William and Montreal; (2) from Montreal to the international boundary near Lake Champlain; (3) from Montreal to Ottawa; (4) from Ottawa to Kingston and Perth; (5) Trenton, Lake Ontario, to Lake Huron (not completed) and (6) the St. Peter's Canal from the Atlantic Ocean to Bras d'Or Lakes, Cape Breton. The total length of the waterways comprised within these systems is about 1,594 statute miles. The actual mileage of canals constructed is 117. The traffic in 1916 was $23,583,491, of which two-thirds originated in the United States; the capital cost of the canals was $118,614,726.

Shipping in Canada entered upon a new phase of construction and expansion in 1918-19 with over 60 new vessels under way or in operation; the total built and registered in Canada in 1916 was only 325, with a tonnage of 102,239, while those sold were 21 of 4,529 tons; the total registration did not reach a million tons. The sea-going vessels which entered and cleared at Canadian ports, with cargo and in ballast, totalled, in 1916. 24,827,650 tons. The sea-going and inland vessels (exclusive of coasting) which arrived and departed were as follows: British, 6,817 of 12,417,944 tons register; Canadian, 37,000 of 17,372,836 tons register, and foreign, 75,411 of 27,930,318 tons register. British vessels (sail and steam) engaged in the coasting trade (arrivals) numbered 84,654 of 34,967,264 tons register; the foreign shipping in this respect was negligible.

The Richest Fisheries in the World

The immense seacoast of Canada on the Atlantic and the Pacific, totalling 12,780 miles, its innumerable bays and inlets, its vast inland lakes and many bodies of fresh water covering an area of 220,000 square miles, its great rivers and streams, which in most other countries would appear to be important rivers, make possible the most extensive fisheries in the world and these Canada certainly possesses. Fish are everywhere on the seacoasts, in lakes and rivers, and they are of the best known varieties for both sport and food; even remote northern lakes, frozen over most of the year, have been found crowded with fine whitefish; owing to cold weather conditions, they can be more easily and cheaply transported and preserved than in other countries. It cannot be said that production is as great as the supply warrants, but it constitutes a valuable industry with a recorded value of fish marketed (1917) totalling $52,352,044—the most of this being from the sea with, naturally, British Columbia and Nova Scotia as the chief producers. The number of men employed was 72,338 with over 26,000 others engaged in the salmon and lobster industries; the value of the total fishing equipment of boats, etc., was estimated in 1917 at $33,520,748.

In the deep-sea fisheries of the Atlantic are the famous cod banks extending from Newfoundland to the shores of Nova Scotia; lobsters, haddock, sardines, herring, mackerel, halibut, hake, are also caught in these waters with Lunenburg, N.S., as the chief Canadian fishing port. The coastal line, with its estuarine and inland waters, extends 5,000 miles and the catch includes most of those mentioned above, with pickerel, pike, whitefish, trout, sturgeon, perch, smelts, flounders, etc.

The Great Lakes and their tributary waters show a yearly catch of millions in value with whitefish, herring, pickerel, pike, perch, carp as the chief fish; most of

these fish also swarm in the northwest waters from Lake of the Woods to Great Slave Lake—in many of them the fish are caught chiefly in winter through the ice. The 7,000 miles of Pacific coast-line include the much-prized salmon of the Fraser and other streams with all the common varieties of fish and oulachans, clams, skate, seals and whales; even the Arctic waters and Hudson Bay produce sea-trout, herring, sturgeon, inconnu, pike, pickerel, cod and salmon with some profitable whaling carried on chiefly by the Consolidated Whaling Corporation which operates 11 steamers. The halibut fisheries at Prince Rupert, B.C., are the greatest in the world.

The once-considered inexhaustible lobster fisheries of the Atlantic coast have been steadily depleted and not even the Dominion and Provincial Governments efforts have been able to counter-balance the results of over-fishing. In the three Atlantic Provinces there are 20,000 acres of natural producing oyster beds and this industry, under scientific culture might give profitable returns. The values of the fish marketed in Canada during 1915-16 show the chief items as follows: cod, $4,486,981; halibut, $2,261,776; herring, $2,906,887; lobsters, $4,506,155; Salmon, $11,262,381. The fish-canning and preserving establishments numbered 982 in 1917 with a capital investment of $48,000,000 and 94,486 employees. Fish-breeding is carried on extensively by the Dominion Government with 59 hatcheries in operation. Government yearly bounties of $158,000, based upon the $5,500,000 awarded by the United States Government in 1877 under the Treaty of Washington, are paid to fishermen; the exports of fish exceed $22,000,000 a year.

Sports and Playgrounds of Canada

Probably the finest variety of hunting, fishing and shooting and the greatest area of sporting grounds and fertile waters in the world, are to be found in Canada. To the wearied seeker after health and strength, the sturdy lover of the wild in life and rugged in nature, the experienced traveller in search of new sensations and of new or picturesque scenery, the adventurous lover of great mountain ranges, vast river basins, rolling prairies or rock-scarred regions which look like some of nature's marvellous ruins, no better country exists than Canada.

In the Rocky Mountains nature has planned things upon the most noble and awe-inspiring scale; the scenery is worthy of the greatest toil and privation, but can be visited today in comfort by the tourist or taken as a sportsman's paradise; in its tremendous ranges Canada has eight great National Parks upon which the Government is spending large sums in development and to fit them to be the great playgrounds of North America. They include Rocky Mountain Park, with an area of 1,800 square miles; Kootenay Park, 650 square miles; Yoho Park, area 560 square miles; Glacier Park, area 468 square miles; Jasper Park, 4,400 square miles; Waterloo Lakes Park, 432 square miles, and Revelstoke Park, 95 square miles. Mount Robson Park, 650 square miles, a provincial reserve in British Columbia; Strathcona Park, 800 square miles on Vancouver Island; the Laurentides National Park (3,721 square miles) in the mountain ranges of Quebec, and the great Algonquin Park—an Ontario playground of 2,721 square miles—must also be mentioned as the chief provincial reserves. The forest reserves of Ontario and Quebec total 150,000 square miles. There is a Dominion Park in Nova Scotia and twelve of the Thousand Islands, in the St. Lawrence, are formed into another.

The vast wilds of the Peace River region and the forests and rivers of the Hudson Bay; the almost inaccessible homes of wild life in Ungava and Labrador; the Nipigon country and Rainy Lakes district containing many wild animals and much game; the Prairie Provinces where ducks and geese and prairie chicken abound and big game are still to be found; the resources in game and fish of northern Quebec; the district north of Parry Sound which is roamed over by deer, bear and moose; the picturesque lakes and summer resorts of the Muskoka region, which constitute the Killarney of Canada; the fishing and shooting of the Maritime Provinces—all these and many more form a range and abundance of sport almost too wide for comprehension.

Other specific points in Ontario are the 30,000 islands of the Georgian Bay; the beautiful Temagami region of lakes, rivers and wooded lands, including the lake of that name with its shore line of 1,132 miles; the Kawartha Lakes and Maganetewan River; Lake Nipissing and the French River with their wild and rugged scenery and splendid fishing and hunting; the Thousand Islands of the St. Lawrence running from Kingston to Brockville.

Moose, caribou, elk or wapiti, the white and black-tailed deer, antelope, mountain sheep and goats, reindeer, the famous musk-ox of the Barren Lands in the far north, bear, ranging from the huge grizzly or white polar bears to the

smaller black or brown bear, wolves and lynxes are the chief big game or wild animals of Canada. Lesser animals include the beaver, mink, otter, marten, ermine or weasel, rabbits, raccoon, skunk, squirrels and wolverine, the coyote or prairie wolf. There are or have been foxes of every variety—black and blue, silver and white and red. Muskrats are to be found in most of the provinces. Grouse, pheasants, woodcock, golden plover, partridge, snipe, rail, quail, duck of various kinds, ptarmigan, sandpipers, wild turkeys, swans, wild geese, are amongst the game birds.

Graylings, in the swift streams of the Rocky Mountains, maskinonge, in the basin waters of the St. Lawrence, ouinaniche in the northern lakes of Quebec and the Ungava peninsula and in some of the New Brunswick and Nova Scotia waters, sturgeon in the Great Lakes, salmon on the Atlantic and Pacific coasts, cut-throat trout in Alberta, rainbow trout in British Columbia and speckled trout in Nova Scotia, New Brunswick, Ontario and Quebec waters, perch, pike and pickerel everywhere, are the chief game fish of Canada. Quebec in particular, and Canada in general, boast a wide range of splendid winter sports which mean not only pleasure but health, strength and vigour and which include hockey, ski-ing, curling, skating, snow-shoeing, sleighing.

The Fur Trade in Canada

Some of the most thrilling chapters in Canadian history mark the fur-trade annals of the Dominion from the early days of the *courreurs des bois* to those of the Hudson Bay trappers and hunters and the sportsmen of the 20th century. It is more than 400 years since Cabot first took furs from Canada to King Henry VII. Over the great prairies of the west there roamed at that time herds of countless buffalo, in the forests of the east were innumerable wolves and bears, panthers and lynxes; in the mountains or on the northern plains were many varieties of deer as well as wilder animals. As civilization and population advanced, the happy hunting days of the Indian, the historic strife of great fur-trading companies, passed away and the wilder animal life of the country decreased in numbers and receded to greater inaccessibility.

The value of the fur-crop of Canada is, however, after a lapse of years steadily growing greater; ten years ago it was $2,000,000 and today must be worth at least $20,000,000 with an export which, alone, totals $13,000,000. To the sportsman, of course, no value can be put on the gradually disappearing big game. The buffalo has vanished entirely except in Government Parks and the antelope, at one time common on the prairies, is fast decreasing in numbers; the beaver, however, is increasing and fur-farming has been applied to this animal in Prince Edward Island where, also, fox-farming has been made a commercial industry with prices ranging from $3,000 a pair in 1910 down to about $800 in 1919 with a total sale of over $2,000,000 in the latter year; silver black fox-ranches are now established in every province while mink farms in Canada number about 50; skunk farms have been tried in Nova Scotia and raccoon and marten are also being "farmed," and the muskrat is largely used for commercial purposes.

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CANADA IN HISTORY

A Picture of the Past: The Indian

Before reaching the shores of Canada it would be well if visitors could see a mental picture of Canadian life in the past. It is a new country but it is one stamped with the impress of great struggles, imposing incidents in a vast environment, sombre and splendid scenes, memories of heroism unsurpassed anywhere. The origin of the North American Indian is shrouded in impenetrable gloom. His personality looms out from a lurid background of tortured settlers, flame-lit settlements and battling pioneers. His character comes to us imbedded in the literature of a hostile and conquering race as the embodiment of cruelty and savagery. Yet the figure of the red man was in many respects a noble one. Cold and hard in character, passionate and revengeful in temper, ignorant and superstitious in belief, keen and quick in thought, the Indian was never, in the days prior to his overthrow, guilty of the effeminate and meaner vices which destroyed peoples such as the Roman and the Moor. Love of liberty in its wilder forms and contempt for all arbitrary rule or personal control he carried to an extreme greater than can be anywhere paralleled.

Sleepless suspicion of others was a natural part of his surroundings of war and treachery. He preferred to drive a secret blow, to use an ambushed arrow rather than to seek open fighting or public revenge; he was dark and sinister in his punishments and retaliations; his warfare was one of sudden and secret surprise, ruthless and unhesitating slaughter. On the other hand, though he had few opportunities for self-improvement, the curious federal system of the Iroquois, the characters of Pontiac, Tecumseh and Thayendenagea indicate individual capabilities under favorable circumstances, or when raised by the white man's sympathy and support instead of degraded by the use of his fire-water and the practice of his immoralities. The Indian was, in short, the product of nature, the outcome of wilderness conditions, the result of long and continuous struggle with the forces of extreme heat and cold and of contact with the wild, free vagaries of a wandering forest life.

The Iroquois, with whom Champlain first came face to face in the inauguration of a drama which had a continent for its stage and a century for its enactment, were at once the best and the worst of all the Indian nations. Their pride was intense and over-mastering, their lust of conquest was individually as strong as that of Alexander or Napoleon, their savage passions and cruelties were vented in an indescribable degree upon their enemies. Yet in courage, constancy and a concentrated energy, it would be difficult to find their equal as a people; where they inflicted pain they were equally ready to endure it.

They included the Mohawks, Oneidas, Onondagas, Cayugas, Senecas and, afterwards, the Tuscaroras, in what was practically a loose federation of nations stretching across the wide lake region and through what was destined to become the State of New York and the Provinces of Ontario and Quebec. In their days of greatest power the Iroquois warriors never numbered more than 4,000 men, though they became a thought of terror to all the tribes from the rolling waters of the St. Lawrence to the sunny slopes of Carolina and from the far west to the Atlantic shores. The kindred races of the Neutrals, the Andastes, the Eries and the Hurons, had all, by 1680, been practically wiped out of existence by this organization of savage strength.

To the French colonists they also became a public scourge, a source of untold suffering and sorrow. So, in a lesser degree, with tribes further south and west and the English colonists of the seaboard. Yet with all the vivid tokens of Indian life and character which are stamped across the pages of Canadian and continental history, it is probable that the vast wastes of North America never saw more than 200,000 savages at any one period. Their wandering and harsh mode of life and their continuous wars prevented the otherwise natural increase in numbers.

Heroic Days of the old French Regime in Canada

The people of Quebec have a pioneer history of which they may well be proud and which presents features of unsurpassed interest to the traveller in what he so vaguely calls a new country. It has to do with a tiny offshoot of a great race, deserted by its own nation, or at times aided in the most perfunctory way, but fighting on and on for a century to create, or hold, or build up, national supremacy over a great continent. The heroic annals begin with the arrival of the sturdy Breton mariner from St. Malo, Jacques Cartier, in 1534. His title in history is a proud one—"Discoverer of Canada." Cartier was the real founder of "La Nouvelle France" when he gave the name of Charlebourg Royal to Cap Rouge. Despite every conceivable natural obstacle of climate and wilderness, wild life and still wilder foes, Champlain had, in 1608, founded Quebec in the shadow of a towering rock, and endeavored to evolve for France an empire in the New World. And until his death in 1635, the Pioneer of French Canada fought a battle of the most extraordinary kind with almost every difficulty which nature and man could place in his path.

He carried his little colony through local rivalries, fur-trade abuses, national indifference at home, official intrigue and the blood-darkened shadow of savage life; while at the same time exploring the interior and discovering Lakes Huron, Ontario and Nipissing. But while Champlain's policy and explorations brought the existence of a continent into the practical knowledge of the world and his settlements laid the foundation of New France, he also was reluctantly and unavoidably embroiled in a conflict with the Iroquois, which resulted in over a hundred years of perhaps the most barbaric and at the same time picturesque warfare recorded in all history.

Side by side with, or merged into this conflict, was the fluctuating warfare between French and English—between the onward sweep of English settlement

and the continuous dream of French dominion—spreading over thousands of miles of lake and river, pathless prairies and trackless forests and reaching from Hudson Bay to the Gulf of Mexico and from the far, unknown wastes of the west to the Alleghanies. The struggle was a peculiar one. Kindling with fierce heat amidst the forests of America at the first signal of war in Europe; often blazing into local conflicts spread over a vast area while the respective nations were nominally at peace; sharing the passions of European pride and rivalry with the added impulse of provincial boundary disputes, commercial conflicts and Indian blood-stained surprises; the struggles of these alien races, stationed respectively upon the shores of the St. Lawrence and the coasts of the Atlantic, were of a character vitally different from the better-known conflicts of personal ambition, religious principles, or dynastic claims, which have reddened the pages of European history.

Battles in North America from the beginning of the seventeenth to the end of the eighteenth centuries did not resemble military conflicts elsewhere. No such splendid natural setting for the contest between France and England which belted the world and included in its scope the vistories of Clive, the ambitions of Frederick the Great, the triumph of Wolfe and the rise of Washington, was anywhere else provided. During much of the period when the respective Mother Countries were at war—and frequently when they were resting or recuperating during an interval of apparent peace—the broad aisles of a primeval forest, the stormy waters of immense inland seas, the untrodden mazes of an illimitable wilderness, constituted the environment of some determined struggles.

The history of the founding of Port Royal (now Annapolis Royal, in Nova Scotia) by the gallant de Monts; the establishment of Montreal by De Maisonneuve (1642); the prolonged battle for existence by Quebec; the strife of Charnisey and de la Tour in Acadia; the gallant dash of Iberville Le Moyne upon the northern regions around Hudson Bay and his destruction of English forces and ships; the expeditions against the English of New York organized by the brilliant mind and determined energy of Frontenac; the Acadian invasion by Sir William Phipps, of Massachusetts; the sieges of Louisbourg and Quebec and the oft-repeated struggles around Forts Niagara, Ticonderoga and Duquesne present some of the most tragic and dramatic scenes ever described by pen or brush.

Around and about the opposing forces echoed the war-whoop of the savage. Over the head of the beaten white man—French or English—rested the shadow of the scalping-knife. The tramp of armed men and the roar of European guns were often preceded by the axe of the woodsman and by a path cut through the the depths of the forest so that the flag of England and the flag of France might "wave in war's alternate chance" over regions known only to the wandering Indian, the adventurous voyageur, or the occasional hunter and trapper. It was, in fact, a battle of giants in an area so vast and varied as to defy the knowledge or the imagination of the contestants themselves.

Yet even when the armies of Amherst completed the victory of Wolfe upon the Heights of Quebec in 1759 and forced the surrender of Montreal, in 1760 the French population of Canada did not exceed 80,000, as opposed to the New England colonies with three millions of people backed by the might of England. For over 150 years New France had maintained a desperate struggle against frightful odds, and at the last the strange blending of martial spirit, aristocratic courage and religious enthusiasm which had held half a continent for the Church and Crown of France was conquered as much by the miserable corruption of Bigot and other mercenary rulers as it was by the skill or vigour of the English.

Still, the result was inevitable sooner or later. Daulac des Ormeaux might, in 1660, take his 16 youthful comrades up to the rapids of the Longue Sault, on the Ottawa, and hold, for eight days and at the sacrifice of their lives, the passage to Montreal against a thousand Iroquois warriors; Frontenac might for a time in the next century hold both the Indians and the English in check; Montcalm might defeat his foes at Oswego, at Fort William Henry and at Ticonderoga; but the one only illustrated French heroism as the others did French military skill and bravery. They could not really compete with the slow, irresistible movement of English colonizing strength or the irrepressible force of the English commercial instinct. Up the valleys of the Mohawk and the Ohio advanced the pioneers of a coming host, and the eastern slope of the Alleghanies heard the axe of the English settler even while Céleron de Bienville was burying plates of lead down through the heart of the continent and marking what he fondly hoped would prove the boundaries of a vast French Empire. The die once cast, the French-Canadian people, led by their devoted clergy, gave steadfast adhesion to the British Crown, and in 1775 and again in 1812-14 fought for the British flag in resistence to American invaders.

A Picture of the Past—The Loyalist

To the United Empire Loyalists Ontario and New Brunswick, Nova Scotia and the Eastern Townships of Quebec owe the fundamental influence in their history and developments; to them Canada owes much of its British faith and Empire evolution. The Loyalists represent in continental annals both the history of a lost cause and the foundation of a new commonwealth. In the former capacity popular ignominy has very largely been their lot in the pages of American history and, sometimes, at the hands of unjust British publicists. In the latter capacity they have become enshrined in the records of self-sacrifice and toil and suffering which have gone into the making of Canada.

The Loyalist migration from the New Republic into the wilds of Canada began in 1785. They came flocking in thousands to the northern land where still floated the flag they loved so well—in ships and in boats, in covered waggons or on foot—until there were, eventually, about 4,500 settled along the shores of the St. Lawrence, 28,000 in the New Brunswick and Nova Scotia of the future, a few in Prince Edward Island, several thousands in the present Eastern Townships of Quebec and probably 10,000 in the Ontario of to day. They came without money, with little food and few resources, with no experience in agriculture ,or pioneer life, and with but small knowledge of how to meet the enormous hardships which they had to face and as to which so far as they were realized there was no shrinking or shirking.

This movement of population is one of the most interesting and striking facts of history. It was not the exodus of a great horde of people unable to earn their living in a European country, and made up of ignorant, uncultured persons unprepared for the responsibilities of political life and action. It was a movement at least as significant as that of the Pilgrim Fathers. It differed from the latter in being the transfer of what may be termed, for want of a better designation, the prosperous upper class of the American community to a country which was a veritable wilderness. Both movements were made for conscience' sake; but one was largely religious, the other essentially political, or patriotic. The Loyalists, in fact, brought to the making of Canada the choicest stock the thirteen colonies could boast. As amongst the cavaliers of England and, indeed, in almost all instances of civil strife in all countries, it was the most eminent judges, the most distinguished lawyers, the most highly educated of the clergy, the members of Council and administrators, the Crown officials, the people of culture and social position, who stood by the King and what he represented. There were many notable exceptions, but not more than enough to prove the rule.

To a great extent the experience of one family, or of one group of settlers in this migration, was the experience of all. Log-cabins, built in the wilderness, with a single room and a single window, were their homes; coarse garments spun from flax or hemp, or made from the hides of animals, were their clothing—intermixed on rare occasions with the silks and laces and ruffles and gorgeous colours which had perhaps been worn in a Colonial court, or had graced the drawing-rooms of a Colonial mansion; furniture was made from the roughest of wood by the unskilful axe of the pioneer; the task of procuring enough of Indian corn and wild rice to eat, or the staving off of actual starvation, was for some time the principal occupation.

Around their settlements or isolated cabins were the wild animals of forest life —wolves and bears and lynxes. In winter time there was always bitter suffering from a cold which then knew little cessation and from a snow and ice which seemed limitless in quantity and paralyzing to their energies. The latter condition also isolated their dwellings until horses and sleighs came, in better days, to help them bear this ordeal of life in the wilderness. Yet they were not absolutely unhappy. They felt deeply and fervently the principles which had driven them into the wilds and, from many a log hut dimly lit by the blaze of a smoky fire, came the evening hymn of "God Save the King" and the word of a clear-voiced hope that all privations and labours might end in the building up of a greater and better commonwealth than the one they had left:

A vast Dominion stretched from sea to sea,
A land of labour but of sure reward,
A land of corn to feed the world withal,
A land of life's best treasures, plenty, peace,
Content and freedom, both to speak and do,
A land of men to rule with sober hand,
As loyal as were their fathers and as free.



THE DOMINION IRON AND STEEL COMPANY'S WORKS AT SYDNEY, NOVA SCOTIA

THE PROVINCE OF NOVA SCOTIA

The Historic Province of Nova Scotia

This Atlantic Province of Canada where the delegates to the 1920 Imperial Press Conference land, has many interests to the visitor, many charms for a prospective settler, many attractions for the lover of history. It has spacious harbours and splendid fisheries, it is nearest of all Canadian Provinces to the Motherland and Europe; it is in close touch with the naval forces of the Empire, the fishing banks of Newfoundland, the coastal trade of neighbouring provinces and states; it invites traffic with all Atlantic countries, islands, seaports and interests; it is nearer to Liverpool than New York by 588 miles, to Buenos Ayres by 137 miles and to Cape Town by 372 miles; it has on Cape Breton Island the only bunker coal field on the eastern coast of America; its produce is marketed in Canada, and the West Indies, on the United States seaboard and in Great Britain; it has easy transportation by cheap water-carriage along the coasts, and up the St. Lawrence, by 1,784 miles of gulf, river, canal and lake which connect Sydney with Fort William and Port Arthur; it has three transcontinental lines of railway and 15 lines of ocean steamers.

The sources of wealth in Nova Scotia are many and capable of much larger development. There are great coal-beds linked by water with Newfoundland iron, the famous apple orchards of Annapolis Valley and the fertile soil of the Cornwallis region; there are the historic dyked lands and reclaimed marshes of the Land of Evangeline, large spaces of wild clover pasturage yielding the finest of Canadian wool, industrial or mining centres such as Halifax, Amherst and New Glasgow, Pictou and Stellarton, Sydney and Sydney Mines. There are considerable supplies of lumber and pulpwood, new developments in water-power and hydraulic energy and a revived shipbuilding industry of large proportions; there are prosperous refineries and evergrowing factories, great iron and steel plants, fishing fleets, working out from a richly indented coast and resourceful waters with Lunenburg and Yarmouth as their chief ports; there are abundant minerals awaiting greater development and including iron, limestone, gold, molybdenum, manganese, antimony, gypsum, salt, pottery-clay, oil shales, vast supplies of caking coal. The Dominion Steel & Coal Company, now the central factor of the New British Empire Steel Corporation, with headquarters at Sydney and the Nova Scotia Steel & Coal Co. of New Glasgow, included in the same consolidation, are amongst the greatest of Canadian industrial plants. The trade of the Province in 1919 was $88,464,969 and its bank clearings $241,300,194.

Through the province run the Liverpool, La Have, Shubenacadia, Avon and Annapolis rivers, its forests still have considerable small and large game, it has excellent trout and salmon waters. The scenery of Nova Scotia includes the high and picturesque shores of Pictou harbour, the beautiful green amphitheatre of Antigonish, the varied and spacious beauties of Halifax harbour, the exquisite scenes of Annapolis Valley, the myriad islands of the Tusket River, the rich and rolling hills of Avon, the clustering farms and orchards of historic Grand Pré—the latter-day birthplace of Canada's Prime Minister, the stormy waters and terrific tides of the Bay of Fundy, the massive front of Cape Blomidon, steeped in tradition and dwarfing in its sweeping size and ponderous proportions all rivals on the coast.

> This is that black bastion, based on surge,
> Pregnant with agate and with amethyst,
> Whose foot the tides of storied Minas scourge,
> Whose top austere withdraws into its mist.

The Island of Cape Breton, which was attached to Nova Scotia in 1764 by the British authorities, has a history and an interest all its own. It is almost split in two by the remarkable inlet called the Bras d'Or Lakes and its scenery is singularly beautiful and varied, with mountains, lakes, streams and deep bays, with waters which constitute a sportsman's paradise, plains and valleys which are exceptionally fertile, coast waters rich in fish and coal-mines which rank amongst the greatest. Its position makes it the key of the St. Lawrence, explains the intensity of the war-struggle which surged around and upon its soil and made Louisbourg one of the strongest of North American fortresses and for fifty years the centre of bitter conflict—the present scene of grass-grown hillocks and buried ruins.

THE DOMINION IRON AND STEEL COMPANY'S WORKS AT SYDNEY, NOVA SCOTIA

Nova Scotia in 1919, with a population of 511,000, an area of 21,000 square miles, a length of 300 miles and an extreme breadth of 100 miles, produced $192,000,000 worth of coal and other minerals, manufactures, fish, ships, lumber, grain and fruit. In preceding hundreds of years it produced traditions and a history worthy of the pride its people feel in the past. The story of Acadia and the Acadians is one of the most attractive as well as the saddest in continental annals; the military struggles of French and English surrounding Port Royal on the Bay of Fundy, from its foundation in 1605 to the days of peace when it became Annapolis, are of lasting interest; the establishment in 1758 of the first representative Legislature in what is now the Dominion of Canada, the influx of United Empire Loyalists to the south and north of the Bay of Fundy add many attractive pages to Canadian history; the agitation led by Joseph Howe for responsible or self-government in the Colony was a stormy incident in national development as was his later effort to keep Nova Scotia from joining the Canadian Confederation.

Sydney
July 27

Sydney is the industrial centre of Nova Scotia. Sydney harbour is one of the best on this coast of many havens for shipping; it is more or less icebound in winter but in summer presents a scene of vivid activity. Beneath parts of it are the deep submarine galleries in which coal-miners use their picks, all along the shores are coal mines with their buildings and freight railways and the evidence of thousands of men at work. On the south-westerly arm of the harbour is the city of Sydney with its population of 25,000 and an industrial activity and productiveness which have made it a place of importance in Canada. Founded in 1785 by Lieut.-Governor Des Barres and a party of United Empire Loyalists, its harbour was at one time a rendezvous for Spanish fishing fleets, it was the scene of various war activities in old-time fighting days; it became the capital of Cape Breton when the island was a separate colony; it was the home of fortifications and barracks and a British garrison up to the time of the Crimean War; it was for long the headquarters of a friendly French squadron in the North Atlantic; now it is the centre of a great coal and iron and steel industry.

The Dominion Iron and Steel Co. has a plant here which cost $35,000,000 and employs 4,000 men; the town is the centre of a great coalfield and iron, gypsum, fireclay, marble, limestone, dolomite and silica are to be found in the vicinity, while the forests of the island contain spruce, fir, hemlock, beech, maple and birch. Some of the minor industries are tar and its by-products roofing materials, slag-cement, pressed bricks, iron castings and sheet metal and structural steel. Large additions are, in 1920, under way to the steel plant, plate rolling mills are under construction and a large milling plant. There are 18 churches, 11 schools, a High School and Provincial School of Science, and five banks. From Sydney the Canadian National Railway runs through the island, the Sydney and Louisbourg Line connects the two places named, an electric railway runs to Glace Bay, Bridgeport, Reserve and other subsidiary mining towns; there is also steamer connection with Montreal, Quebec, Halifax, Newfoundland, Prince Edward Island, etc., and the place is a bunker port for many ocean liners.

Around Sydney are three other mining centres and, 24 miles away, is Louisbourg, an historical ruin which once held high place amongst the world's fortresses and in the stirring life of pioneer days. Sydney Mines, with a population of 9,000, lies on the harbour and is closely associated with the great New Glasgow industry —the Nova Scotia Steel and Coal Co. employing 4,300 men at this point to operate its collieries and brickyard; the yearly output of coal is 900,000 tons. North Sydney is at the entrance of the harbour and 15 miles from Sydney. Steamers run from it to Newfoundland and the French Islands of St. Pierre and Miquelon; its industries include coal mining, deep-sea fishing and trawling, granite and marble works, heavy machine and boiler works, stove foundry, fish-drying and smoking plant, seal and cod oil-refining plant; there are wireless and seaplane stations, coal shipping piers and a marine slip for ship repairing. The population is about 6,000.

Glace Bay is 14 miles from Sydney, has 18,000 people and is the centre of the Dominion Coal Company—affiliated with the Dominion Iron and Steel Co. as the Dominion Steel Corporation. This concern pays average wages of $500,000 a month, employs 10,000 miners and has an output of 5,000,000 tons a year. Other industries include fishing interests and machine works; freight steamers run to Halifax and there is much shipment of coal; it is surrounded by a rich farming district and has 12 churches and 12 schools with a Provincial Mining School and four banks and a Marconi wireless station.

Leaving Sydney, by Canadian National Railways, the trains run through Cape Breton, cross the Straits of Canso, and pass through New Glasgow and Truro en route to Halifax. New Glasgow is situated on the East River, in Pictou County, with a population of 9,000. It is chiefly known as the seat of the Nova Scotia Steel and Coal Co., with its important shipbuilding yards, rolling mills' forges and finishing department, its large capital and production and employment of labour. There is, also, the Eastern Car Co., building varied types of steel and wooden freight cars and employing 3,500 men, the Eastern Steel Co., the Maritime Bridge Co., McNeil Machine and Motor Co. Other industries include mining tools, wooden ships, glass, harrows, bricks, mineral waters, saw-mills, planing-mills, steel and wire fencing, foundry, electric works, drain pipes, clay products. In the neighbourhood are supplies of coal, limestone, iron-ore, hardwood and spruce.

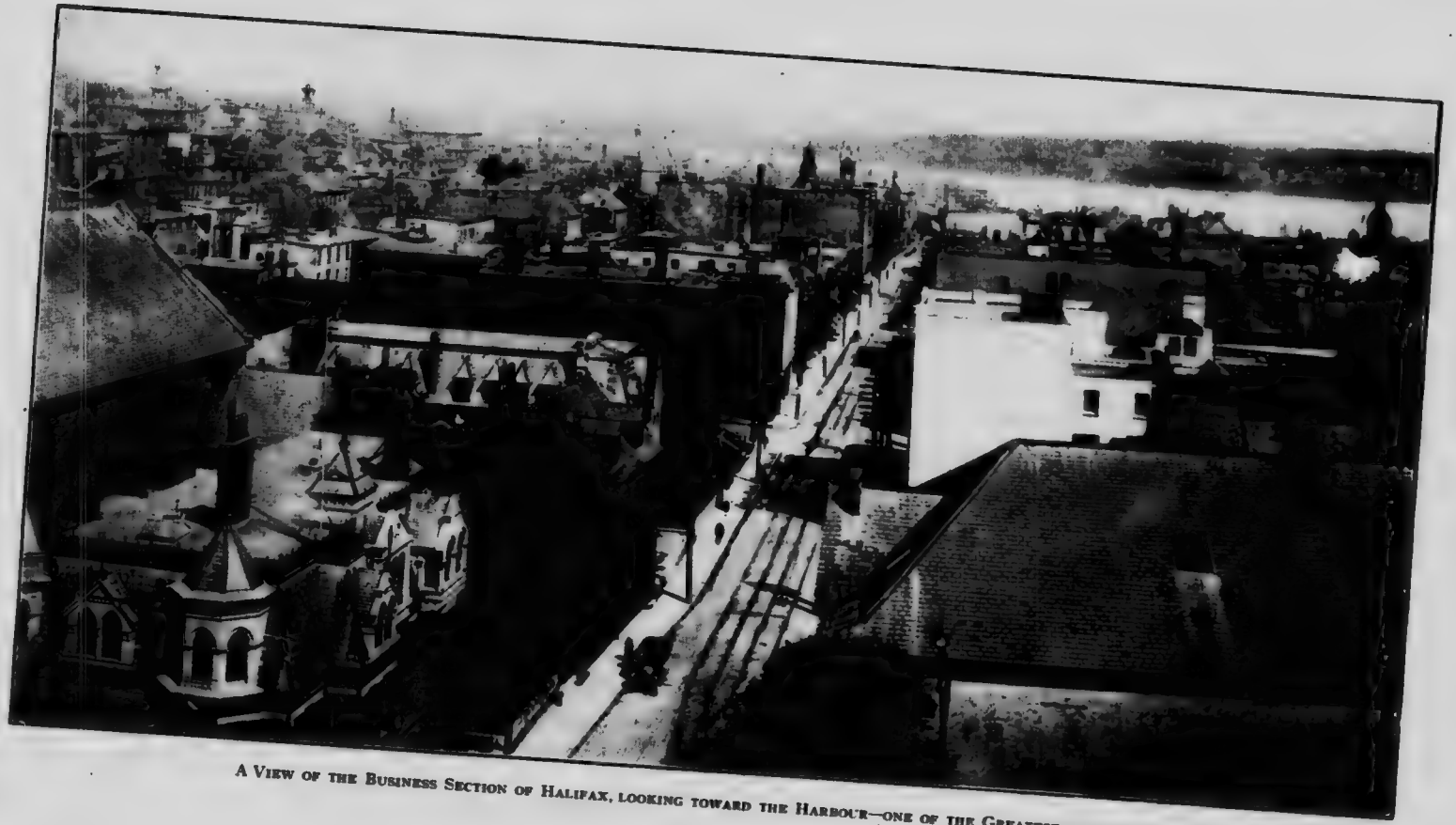
A town of importance nearby, to which the exigencies of a crowded schedule will not permit a visit, is Pictou. Placed at the head of a noble harbour with lofty shores and picturesque scenery and a most safe and commodious anchorage, this town of 3,000 people dates from unknown periods in Indian legend as the site of Pik-took, a Micmac place rich in tales of Gluskap, the god of the tribe; the scene also of sanguinary struggles with the Mohawks, the centre of a small Philadelphia settlement in 1767 and of more successful Scotch-Highlanders six years later. In succeeding years it became a lumbering and shipbuilding port and long years afterwards a centre of the coal industry which has made the surrounding country prosperous. The Pictou Academy, founded in 1810, has had a distinct influence on the educational life of the Province and has trained such well-known Canadians as Sir William Dawson of McGill and George M. Grant of Queen's University. The town has industries which include flour and feed mills, biscuits and candy, foundry, marine railway, electric plant, etc. In the neighbourhood are good fishing and fair hunting.

Halifax
July 28

Halifax is a fitting portal to the half of a continent which stands behind and pulsates with the new life of a growing nation. It joins the old with the new, and its splendid harbour brings the sea-power of Britain, the fleets and commerce of the Old Land into touch with the productive greatness of the Dominion; its military and naval station, its soldiers in barracks and sailors and warships in the harbour, connect the great associations and history of the United Kingdom with the war-spirit and life of the new Canada. The city is situated on a pear-shaped peninsula, about five miles long and three broad. Citadel Hill rises about 250 feet above the waters which it faces, the splendid harbour, one of the largest, safest and one of the best fortified in the world.

It has a population of 60,000 and the point of its peninsula constitutes a beautiful city park, which contains within its 200 acres of forest drives three camouflaged or masked ports, forming, with Forts McNab and Ives on the island to the east and York Redoubt on the west, a complete encirclement of the outer harbour and cover to its entrance. The Northwest Arm, George's Island, the Narrows and Bedford Basin are picturesque natural features of the city, with Dartmouth as a virtual suburb of 7,000 people, and a number of important manufacturing establishments, lying on one of the sides of the harbour. The Northwest Arm, Bedford Basin and the dockyard, the dry-dock, said to be the largest on this continent, and Point Pleasant Park, a public resort owned by the Imperial authorities and leased to the city of Halifax, are all of interest and deserve a visit. As a railway centre, it is the terminus of the Canadian National Railways, the C.P.R., Dominion Atlantic and Eastern.

Dalhousie University, founded by the ninth Earl of that name in 1818, affiliated with Oxford and Cambridge, and keeping pace with the progress of the times, is an institution adding notably to the interest of the city; it has its faculties of arts, science, law, medicine, dentistry and pharmacy, with a Government representation of modern business in education—the Nova Scotia Technical College. Theology is represented in the Presbyterian College, Holy Heart College and St. Mary's College. The city is the seat of the Provincial Government and the Parliament Buildings and Government House; it has forty-two churches and two convents, five public gardens and over eighty factories of various nature. The industries include steel shipbuilding, iron foundries, sugar-refining, machinery, agricultural implements, cotton and woollen goods, paper and musical instruments, gunpowder, tobacco, soap, candles, paints, chocolates and spices; its exports



A View of the Business Section of Halifax, looking toward the Harbour—one of the Greatest in the World

totalled $41,697,142 in 1919, and imports $15,071,155, while its bank clearings in the calendar year 1919 were $241,300,194.

The Dominion has spent, or is spending, $30,000,000 in construction of new terminals, which should make Halifax one of the best-equipped ports in the world. From it a number of steamship lines radiate, including the Canadian Pacific Ocean Services, the Canada-Jamaica, the Cunard, Donaldson, Furness, Manchester, Holland-American, Nova Scotia S.S., Pickford and Black, R.M.S. Packet, White Star-Dominion, Cie General Trans-Atlantique and lesser lines. Under construction in 1920 are warehouse and piers for the French Cable Co., a $2,000,000 refinery plant for the Imperial Oil Co., and a $6,000,000 plant for the Halifax Shipyards Limited. Recovery from the great war disaster of 1917, when the explosion of a munition ship, the "Mont Blanc," in the harbour, caused the death of 2,000 persons and destruction of many millions of property—homes, plants, churches, shops, etc.—has been so rapid and complete as to be a matter of much interest. Over $25,000,000 was subscribed to help the city, including $17,000,000 by the Canadian and $5,000,000 by the British Governments and $3,000,000 from other sources.

Founded on June 21-30, 1749, by the landing of 2,500 settlers under Admiral the Hon. Edward Cornwallis, and sent out by Lord Halifax, President of the Board of Trade and Plantations, it was for many years a chief seaport of British power on the Atlantic, the filter through which British troops passed to fight in various parts of the continent, the harbour to which prizes of war were brought and a centre at which British prisoners of war were held. In 1758 it held for a time General Amherst's 12,000 men, while Boscawen's 23 ships of the line, 18 frigates and 120 transports filled its harbour with warlike scenes. In that year it saw the first representative assembly of British America; it was the centre of Joseph Howe's eloquent and stormy political advocacy; from it, in 1833, passed the first ship under steam power to cross the Atlantic. For many years it has been one of the most strongly fortified as well as most commodious harbours in the world, the chief British naval station in the North Atlantic, with a dry dock which served the mercantile as well as the Royal Navy and was for long the most costly and largest upon the continent. Halifax has been, indeed, for a century and a half what the Prince of Wales described it in 1919: "A bulwark for the British Navy in the West."

"Into the mist my guardian prows put forth
Behind the mist my virgin ramparts lie,
The Warden of the Honour of the North,
Sleepless and veiled am I."

Leaving Halifax by the Dominion Atlantic Railway, the trains run through the beautiful scenes of Acadian history immortalized by Longfellow as the Land of Evangeline, which will be seen on the return journey by daylight, and arrive at Kentville. The Annapolis and Cornwallis Valleys, of which this is the centre, are beautiful and fruitful regions stretching 80 miles down through the Province from Wolfville to Annapolis, with a width ranging from four to twelve miles. They are protected from the cold fogs of Fundy and ocean winds of winter by the range of hills called the North and South Mountains. Covering the counties of King's and Annapolis, they produce apples famous on continental and British markets, with a provincial production of about 1¾ million barrels—and have climate and soil suited to grapes, pears, plums, cherries, melons and even peaches.

Kentville
July 29

Kentville, a busy town of about 3,000 in a charming valley. It is the business centre of this region, 71 miles from Halifax and boasts a Government experimental farm, a militia camp and a provincial sanitarium; its industries include carriages, gasoline engines, foundry, milling machinery, and there is salmon fishing in the vicinity for the sportsman. Delightful drives can be taken to Hall's Harbour, Baxter's Harbour, over the North Mountain and along the Bay of Fundy shores. Motors take the party to Canning, Kingsport, Starr's Point, Church St., Port Williams to Wolfville.

Wolfville
July 29

Wolfville, 65 miles from Halifax, is the headquarters of visitors to this region and the seat of Acadia University—a well-known institution—founded in 1838, affiliated with Oxford and McGill, having 19 teachers and (1916) 120 students, with 500 in residence at Horton Academy and Acadia Seminary, which are popular supplementary institutions. Embowered in orchards, the scenes around this pretty

town were once described by C. G. D. Roberts, a Nova Scotian poet and historian, as follows: "Before the windows of Wolfville unrolls a superb view—marshes of pale green, reclaimed from the sea by the spades of old-time Acadian farmers; sharp stripe of red or orange—tawny flats, where the retreating tide has left the beach uncovered; to the left front a well-grouped cluster of white cottages, spires and masts above a bridge—the shipping village of Port Williams; the long, low lines of green upland outstretching from either side to almost the centre of the picture—the delicious summer retreats of Starr's Point and Long Island: between them and beyond, away to the far blue barrier of the Parrsboro Shore, the restless waters of Minas Basin, yellow in the foreground, but in the distance purple, sapphire, green or silver, as changing hour and changing sky may decree; and in the middle distance, dominating all the scene with its mass of sombre indigo, the majestic bastion of Blomidon out-thrust against the tides. These are effects of full daylight; but by the aerial magic of sunrise (too seldom seen!) and the voluptuous sorcery of sunset such transformations are wrought as make the scene a never-changing realm of faeiry"

The present town has the advantage of being close to the mouth of the Cornwallis River as it runs into the Basin of Minas; it has a daily boat to Parrsboro, its coal-shipping and industrial port, and to Kingsport, with a weekly one to St. John; it has shaded, well-kept streets, comfortable homes; its simple industries include the farming of the population around, a creamery, corn-mill, a sash factory; its residents number about 2,000.

Grand Pré
July 29

Three miles distant is Grand Pré itself, once the centre of the historic scene of Acadian banishment and sharing with Minas and Annapolis in 1755, the famous dispersal and exile of 6,000 French-Acadian settlers and their distribution throughout the Thirteen Colonies and even as far as England and the West Indies. Around this episode, tradition and the poetic pen of Longfellow have woven threads of subtle beauty and passionate patriotism which add charm to the already great fascination of the scenery and to storied meadows in which are buried treasures of that olden day. Willows, planted by Acadian hands, mark the lines of the Grand Pré village as it extends along in a single street after the style still popular in Quebec—a village which is now only a rich and scattered settlement of contented farmers.

Truro
July 29

Truro is the next important point to be reached on the way to Cape Breton. It stands on the fertile shores of the Salmon River at the head of Cobequid Bay on the Bay of Fundy. Founded in 1761 by the Acadians and afterwards settled by immigrants from New Hampshire and disbanded soldiers, it has withstood more than one storm of war, but has now settled down as a thriving centre of agriculture and business with the Canadian National and Dominion Atlantic Railways feeding its industries and with a population of 7,000, three banks, eight schools and nine churches. Its manufactures include knitting mills, condensed milk and coffee, shirts, hats and caps, feed mill, mattresses, wood-working and aerated waters. It is the seat of the Colchester County Academy, the Provincial Normal College and the Nova Scotia College of Agriculture with (1916) 20 teachers and 54 pupils. On its outskirts is the Joseph Howe Park of 1,000 acres, which has been described as the prettiest and most picturesque pleasure-ground in the Maritime Provinces; back of it runs the Shubenacadie River with shipyards at its mouth and a notable tide at this point of tremendous power.

Leaving Truro, the trains during the night climb the Cobequid Mountains, cross the border into New Brunswick, and pass through the city of Moncton, one of the most prosperous and progressive communities of the Maritime Provinces. A divisional point on the Canadian National Railways and a natural centre of commercial distribution, it is growing very rapidly and has a promising future. It is the only eastern city with a natural gas supply. Leaving Moncton, the railway goes through a beautiful and fertile section, and follows the valley of the Kennibecasis River into St. John.

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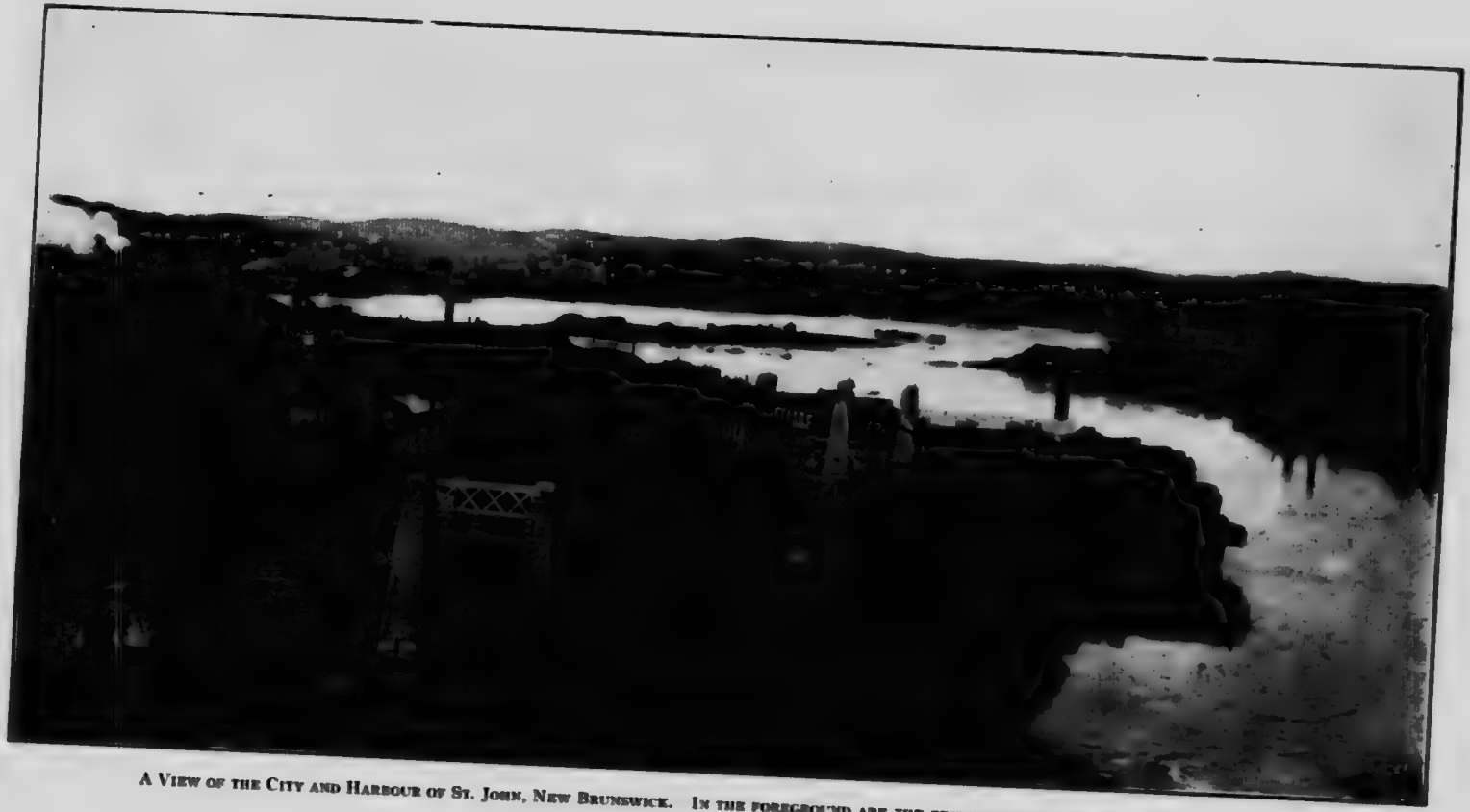
THE PROVINCE OF PRINCE EDWARD ISLAND

The unfortunate delay in the arrival of the S.S. *Victorian* has made impossible a proposed visit to Prince Edward Island. Here is a garden of 2,134 square miles and 93,000 people, with a rich, red soil only one-half cultivated though almost all of it is fit and fertile, with a healthy climate and not very severe winters, with a splendid top-dressing for the farms in mussel mud, which is found in all the bays, with prosperous mixed and fruit farming and abundant room for more. Its fisheries, chiefly lobsters and oysters, are important to the Island people and produced $1,148,201 worth in 1918; its fur-breeding industry has become widely known—especially in silver-black fox and beavers, and the humid temperature is said to produce remarkably fine fur; it is an ideal region for summer resorts and bathing beaches, for boating and fishing in deep bays and inlets and for trout-fishing in particular, for summer climate and accessibility.

Historically, the Island has been largely a land of peace. Originally named St. Jean, or St. John, by Champlain, and having a population of 4,000 when taken possession of by the British in 1758, it was for some years a part of Nova Scotia. Since 1770 it has been a separate British province with a short interval in which it was held by the Americans; in 1800 it was re-named after Prince Edward, Duke of Kent, the father of Queen Victoria, and its real period of settlement began with the immigration efforts of Lord Selkirk in 1803. Charlottetown, founded in 1768, is a city of 12,000 people, situated on an excellent harbour and at the confluence of three rivers, with several important industries and 70 fox farms in the near vicinity. It is the seat of provincial government and two cathedrals, and the home of the Prince of Wales College and the Roman Catholic College of St. Dunstan.

Summerside, 48 miles from Charlottetown, is second to the latter in importance. It has excellent stores and handsome residences. Among its business places is a mail-order house whose ramifications extend over the Maritime Provinces and whose turnover runs into several million dollars a year. It is the centre of the Island's famous fur-farming industry.

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A View of the City and Harbour of St. John, New Brunswick. In the foreground are the bridges over the famous Reversing Falls

THE PROVINCE OF NEW BRUNSWICK

The Loyalist Province of Canada

New Brunswick has an area of 27,911 square miles, or about that of Scotland, with a population of 351,000 or one-tenth that of the northern part of Britain, with the great inland sea or Bay of Fundy almost completely separating it from Nova Scotia and providing not only a winter port always open, but restless tides which are notable for scenic effects and which often rise 55 feet in one great volume of water; with an extensive system of navigable rivers including the St. John which lighter vessels can use as far as Grand Falls—225 miles from the sea—the St. Croix, the Petitcodiac, the Miramichi, the Richibucto, the Restigouche, all running through tracts of low-lying alluvial land of remarkable fertility; with a large number of beautiful small lakes affording abundance of good fishing, and forests which still supply spruce, pine, hemlock, birch, cedar, maple, oak, elm, etc., in commercial quantities; with hunting grounds which include the moose, caribou and deer in considerable numbers; with notable sea and other fisheries yielding $6,333,000 of product yearly—the famous salmon and trout in the inland lakes attracting a large circle of sportsmen; with mines not greatly developed but with undoubted coal, iron and limestone resources, and manganese, gypsum, building stones, shale and natural gas under production.

There are 17,910,400 acres of land in the Province with over 13,000,000 acres suitable for agriculture and only 50 per cent. occupied. Along the Bay of Fundy are immense areas of reclaimed marsh lands famed for wonderful productivity, year after year without fertilizers; very extensive areas of land especially for the cheap production of wool and mutton offer additional opportunities. The Province's greatest resource, however, is its forests. Of the 7,500,000 acres still in the hands of the Crown, the examination of 1,400,924 has revealed that 73.14 per cent. support merchantable timber, of which 39.4 per cent. represents the hardwood stand. Large quantities of white birch and poplar are available for further utilization.

Historically, the Province owes its birth to the United Empire Loyalists who, with such goods and chattels as they could carry, poured into the region north of the Bay of Fundy and, within a year of 1783, had become so numerous that their territory was marked off from Nova Scotia or Acadie as a separate government and named, in honour of the British Royal House, New Brunswick. In its early history lumber was the great industry and was favoured by England through a preferential tax on Baltic timber; wooden ship-building also developed while agriculture was neglected and foodstuffs imported. A timber forest fire in 1825 swept the colony from the Bay des Chaleurs to Miramichi and destroyed trees, crops, stock, buildings—the loss of timber being incalculable. The responsible government struggle was somewhat similar to that of Nova Scotia, except that L. A. Wilmot, the leader, was not such an oratorical and aggressive character as Joseph Howe. The total trade (March 31st, 1919), it may be added, was $173,289,616 in exports and $22,327,177 in imports; the bank clearings of 1919 were $153,139,927.

St. John July 30

Founded by United Empire Loyalists on May 18th, 1783, upon the site of an old British fort made famous by the exploits of Charles La Tour, and originally called Parrtown, this settlement was incorporated in 1785 as the city of St. John and established as the seat of government. A little later the titular honour passed to Fredericton, 85 miles up the River St. John, as being more central and less exposed in those times to the frequent menace of French or American war; but nothing could deprive it of the advantage of position and its future as the chief centre of provincial trade and maritime business for the Province. In 1919 its imports totalled $15,701,446 and its exports $149,986,167, with bank clearings of $153,000,000—the only clearing office in the Province. The population and political life of St. John were always of a conspicuously intelligent character; its citizenship was based upon the high level of Loyalist settlement and its old families left a deep impress upon provincial life. Between 1824 and 1877 the city had five great fires—the latter deprived 13,000 people of their homes and destroyed $27,000,000 worth of property. An open summer and winter port, St. John is the terminus of the C.P.R., the Canadian National Railways and the New Brunswick Southern Railway. From St. John the Canadian

Pacific Ocean Services, Canada-South African, Canada-France, Canadian Government Merchant Marine and Eastern S.S. Corporation Lines, have regular sailings; so do the Furness, Head, Houston, Manchester Lines and the New Zealand Shipping Co., Nova Scotian S.S., and the Royal Mail Steam Packet Co.

The city occupies a high rocky peninsula, many of its streets have been blasted or hewn out of the solid rock, its hilly walks require active climbing, its views are many and attractive, its harbour capacious and free from ice or tidal currents. The chief industries of St. John are the railway elevators, a pulp mill and several large sawmills, rolling mills and foundries, engine and boiler works, edge toolworks and cotton mills, cornmeal mills, brushes and brooms, paper and wooden boxes, marble works, paint, boots and shoes, fertilizers, sugar-refining plant, sardine factory, ship-building. The total valuation for assessment is (1918) $48,915,000 and its population about 60,000. St. John claims to be the only city in Canada which owns its own harbour; it was the first to be incorporated and the first to adopt municipal government by a commission; it has large Dominion Government improvements going on with new deep-water docks providing berths for 24 ocean liners of the largest type; a new dry-dock is under construction which will be the largest in the world, and in the harbour as a whole 23 wharves are being built. The total cost will be $25,000,000.

The St. John Valley Railway also promises considerable additional facilities, while the Canadian Pacific has just completed a million-dollar elevator and several large new manufacturing establishments have recently been finished.

The St. John River, "The Rhine of America"—with its wonderful "reversing cataract," should be seen by every visitor; also the fine traffic bridge and railway cantilever bridge near the falls. Steamers ply between St. John and Digby, N.S., making connection with the Dominion Atlantic Railway at Digby for Halifax and Yarmouth—a favourite route between the cities of the two provinces. The Eastern Steamship Line gives connection with Eastport, in Maine, Portland and Boston. The Reversing Falls are a natural phenomenon; at flood tide the water is falling in one direction, at the ebb it is falling in the other direction. In between there is not the vestige of a fall. There is at one moment a seething mass of mad surges, at the next a placid surface of mild waters. An elaborate work, called "Picturesque Canada," has described the phenomenon as follows: "The whole volume of the great St. John River, which is nearly 500 miles long and four or five in breadth, half a dozen leagues above the city, at this point finds its way to the sea through a deep ravine, a couple of stone-throws across, spanned by a suspension bridge. When the ebb-tide has emptied the harbour, the accumulated river-waters fall through this ravine as through a mighty sluice-gate. As the tide returns the fury of the escape is diminished, the river is gradually checked, till a level is reached on either side of the great gate, and quiet reigns while the antagonists take a breathing space. But soon the tremendous Fundy tide overpowers the river, bears it down, and roars triumphing through to brim the upper basin. Before it can accomplish much in this direction, however, its retreat is ordered, and the recovering river presses on its rear. This battle is fought twice every day and the river is so far successful that it holds its freedom, and it can never be subjugated into a tidal river with drowned shores and banks of ooze."

Fredericton
July 31

This city of 8,000 people was founded in 1784 by Loyalists upon the site of a French fort dating back to 1692; it became, almost at once, the capital of the colony and was for many decades the headquarters of a British regiment; it has been a military, judicial, political and ecclesiastical centre for a long time. Here the C.P.R., Canadian Government Railways and Fredericton and Great Lake Railways meet; and steamers run to and from St. John. It is the seat of an Anglican Cathedral, the House of Assembly meets here; the University of New Brunswick, founded in 1800 and affiliated with Oxford, Cambridge, Dublin and McGill, with 11 teachers and 116 students, holds an important educative place; the Provincial Normal School, a Dominion Experimental Farm, Victoria Hospital, a military hospital and seven churches have a place in the life of the city. It has four banks and its industries include a grist mill, canoe and motor boat factory, boots and shoes, larrigan and shoe pack tanneries, lumber-mills, farm implements, concrete blocks, etc. It is the centre of a lumbering district with antimony, tungsten and coal in the vicinity; it is the home of sportsmen's preparation for moose grounds, to be reached within six hours. From Fredericton on the way to Quebec by the National Railway or the C.P.R. the visitor travels to Edmundston, the seat of a large bleached pulp

mill, hydro-electric light and power, the centre of a lumber and farming district, headquarters for sportsmen—with fish and big game abundant.

The Valley of the St. John

The River St. John drains an area of 30,000 square miles and with its tributaries furnishes 1,300 miles of navigable waters. After a course of its own covering 450 square miles, it discharges its flood through a narrow, rocky gorge, into the Bay of Fundy. Down its waters every year are floated 125,000,000 feet of lumber; along its shores may be seen beautiful and infinitely varied views; the trip up the river or along its shores is an equally delightful experience. In the quantity of land available for cultivation through railway and waterway facilities and in its wide range of varieties in fruit which can be profitably grown and marketed, the lower part of the St. John Valley is one of the finest in the Maritime Provinces or in Canada.

It is acknowledged to be one of the most fertile and beautiful valleys in the world and it awaits only the systematic development of its fruit lands to blossom forth into one of the best apple regions in all Canada. No official survey has been made in this respect, but the soil and position of the land—especially along the river—speak for themselves. Much of the soil further back is also first class and considerable areas of excellent apple land are to be found even 20 miles or more from the river. There are also many acres of high intervale land, in the vicinity of Sheffield and Maugersville, which would yield handsome returns. The soil is a dark loam, several feet deep, and is exceedingly fertile as being part of the old river bed. Here may be seen apple trees nearly 100 years old, still strong, thrifty and bearing fruits. Around French Lake and Maquipit Lake, are areas of soil similar to that on the western bank of the river—much of it first class apple land, and still more of it in the Grand Lake region and further south in the sections bordering the Washademoak Lake and Belleisle and Kennebecasis Bays.

Woodstock July 31

The Upper St. John Valley, between Fredericton and Woodstock, has proven itself adapted to the production of early or mid-winter fruit, and at Woodstock, 160 miles from St. John, there may be found today the relics of the old Sharp orchards—apple trees planted in tens of thousands by Francis P. Sharp, one of the most noted horticulturists in America. These orchards in their prime were the wonder and envy of all who saw them, and their produce sold for higher prices on the Boston market than local grown fruit. But with the completion of the St. John Valley Railway, which skirts the west bank for a considerable distance, immense blocks of first-class fruit lands between Woodstock and Fredericton, have come within easy communication of the marketing advantages of the lower St. John Valley. Woodstock has a population of 4,000 and is the center of industries and a rich farming country.

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VIEW OF QUEBEC AND ITS WONDERFUL WATERWAY—THE CHATEAU FRONTENAC IN THE FOREGROUND

THE PROVINCE OF QUEBEC

After leaving Woodstock, a night's run—during which the trains leave New Brunswick and enter the Province of Quebec—Levis, on the south side of the St. Lawrence River is reached in the morning. The river is crossed on the famous Quebec Bridge, which has been called the "eighth wonder of the world," and the historic city of Quebec is reached.

Quebec Bridge or the spanning of the St. Lawrence at Quebec was planned as far back as 1853; a charter which was never used was obtained in 1882; the Quebec Bridge Co. was incorporated in 1887 and construction proceeded until the south cantilever arm collapsed in 1907 and the Government took hold of the undertaking. The St. Lawrence Bridge Co. then received the contract and the work was about completed, when on Sept. 11, 1916, the centre span collapsed while being hoisted into position—owing to the failure of one of the castings in the hoisting apparatus. On Sept. 20, 1917, the new span weighing about 5,000 tons was finally lifted into place. The bridge provides 10 railways with passage across the river and quick connection between the immense pulp forest and mills of Northern Quebec and the markets of the Eastern States.

The Portals of the Dominion; Scenic Beauties of the St. Lawrence

As with the Thames in England, the Seine in France, the Rhine in Germany, the Mississippi in the United States, the Ganges in India, the Tigris in Asia Minor, myriad traditions and the history of nations have left their impress around the name of the St. Lawrence. This great river comes down to the Gulf of St. Lawrence under various names. From the little River St. Louis it pours through the great inland sea of Lake Superior and the St. Mary's River, with its crowded canals, into Lake Huron; thence in another outflow, through the St. Clair and Detroit Rivers to Lake Erie and from there by the Niagara River and its wonderful Falls, to Lake Ontario.

From Lake Ontario, for 750 miles, it rolls to the Gulf and the ocean under its own historic name and is never less than a mile in width. As it broadens and deepens into beautiful lakes or narrows and shallows into restless rapids; as it sweeps past cliffs crowned with verdure or great natural ridges capped with dense forests; as these break frequently to reveal fertile valleys and a rolling country, or rise into rugged and yet exquisitely picturesque embodiments of nature such as the Heights of Quebec there comes the thought that here, indeed, is a fitting entrance to a great country, an adequate environment for the history of a romantic people, a natural stage-setting for great events and gallant deeds.

Though greater than any other Canadian river, the St. Lawrence is a natural type and embodiment of them all. Sweeping in its volume of water, sometimes wild and impetuous, never slow or sluggish, on its way to the sea; ever changing in its currents and rapids and waterfalls, in its lakes and incoming river branches; passing through varied scenery yet always preserving in its course a degree of dignity which approaches majesty; it reveals a combination of volume and vastness, beauty and sombreness which make it, in more senses than one, the Father of Waters on this continent—"the great river without an end," as an Indian once described it to Jacques Cartier.

If, indeed, the French sailors seeking new, unknown lands in far Cathay, or the French explorers planting roots in the soil of a vast new continent, more deeply and more firmly than they knew, had deliberately sought the most splendid setting in the world for dominion and settlement, they could have found none greater than that of the New France which grew slowly around and beyond Quebec with the St. Lawrence at its feet. Cartier and Champlain and De Roberval, and the stream of French voyageurs and trappers, soldiers and priests, noblemen and peasants who traversed the waters of the great river in the 16th and 17th centuries, saw however, no such scene as can be witnessed today with its peaceful accompaniments of civilization and commerce.

The greatness and the gloom, the grandeur and the grace, the sternness and the silence of the majestic river were purely as nature had made them. There were long miles of lofty cliffs surmounted by dark forests which echoed from time to time the wail of the wolf or the war-song of the savage while all the icy blasts and unknown terrors of winter, on the verge of some vast wilderness, were faced by men fresh from the sunny slopes of France; there were the marvellous and gloomy portals of the Saguenay, the varied scenery at the mouth of other great rivers, as they poured from mysterious inland reservoirs into the great waterway;

View of Quebec and its Wonderful Waterway—The Chateau Frontenac in the foreground



RUE SOUS LE CAP, ONE OF THE QUAINT OLD BY-WAYS OF OLD QUEBEC

there was the exquisite beauty of the summer and autumn seasons when the shores revealed so much of nature's wooded charm and beauty and the river itself showed graces all its own, crowned by a silence, a solemnity and a mystery, which must have seemed like an inspiration of the gods to the pioneers of that adventurous day.

The picturesque procession of historic figures passing up and down the St. Lawrence, fighting for life and homes upon its shores, traversing in war and peace the vast wilds of the Iroquois, could not, of course, realize that the immense system of waterways, which they were tentatively exploring, contained more than one-half the fresh water of the world; they could hardly think of the Great Lakes as a Mediterranean Sea set in the midst of a continent, with shores skirted only by parties of wandering savages, or understand that all these vast bodies of water were united and were really parts of one majestic river; they could not see into the dim future or dream of the St. Lawrence as proving to a greater Canada what the Nile was to ancient Egypt—crowded with river, lake and ocean steamers, carrying supplies for many millions of people and bearing on its bosom a tonnage of commerce greater than that of the equally far-off Suez Canal.

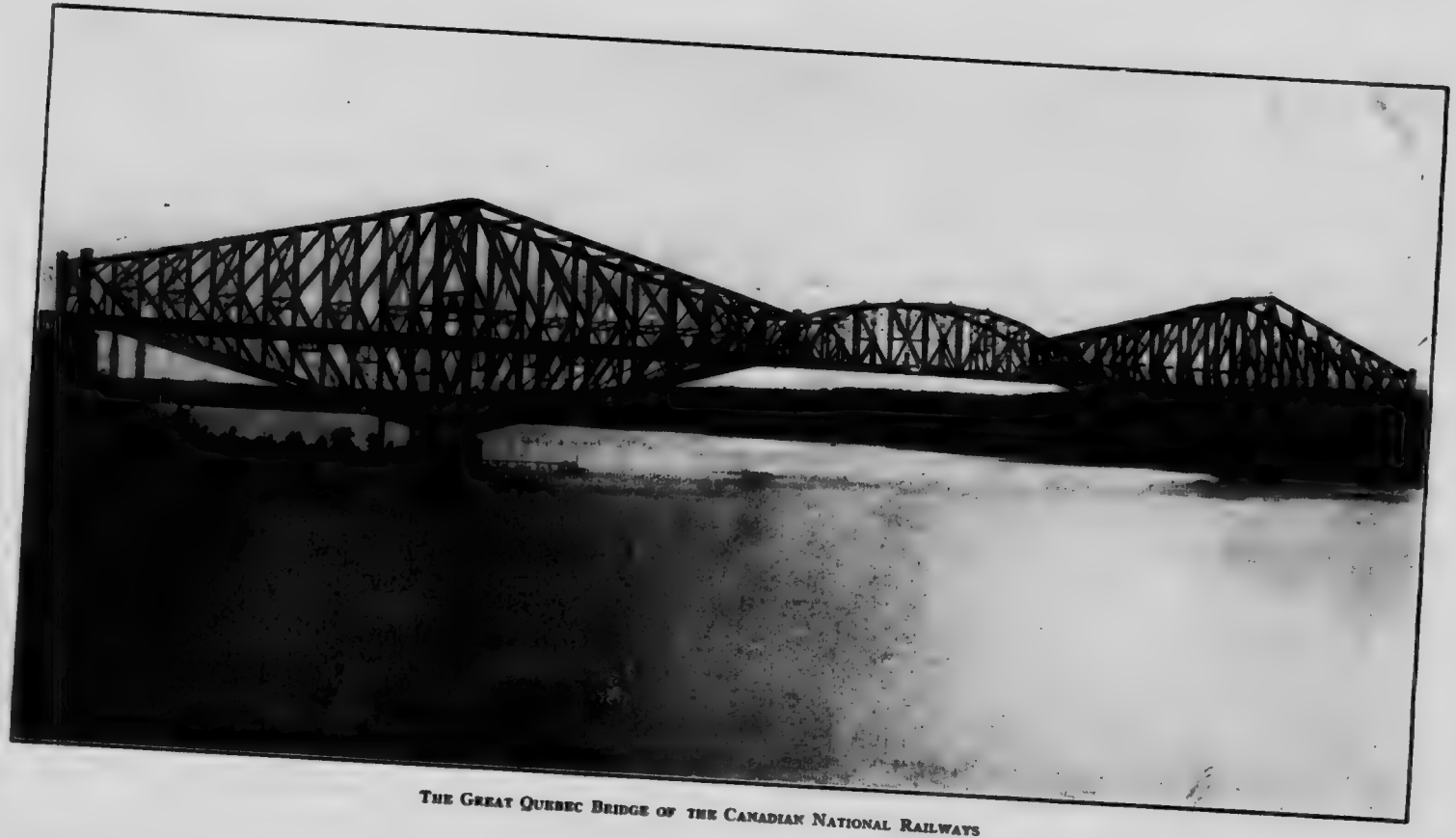
The wars of this time and of a succeeding century between French and Indians, French and English, French and the Thirteen Colonies, the British and the Americans; the tortured annals of the Jesuit Fathers in the wilderness of the Huron and Iroquois tribes; the adventurous exploits of the voyageurs as they hunted and trapped and mastered the lore of the savage and the wisdom of the woods; the alternate war-whoop of the savage and the roar of cannon in the primeval forests and along the shores of these great waters; evolved a pageant of history unique in its stage setting, in the vastness and wildness of its environment, in the picturesque character and life of its people.

The Province of Quebec

The largest and, in some respects, the most famous, certainly the most interesting of Canada's greater Provinces is that of Quebec. With an original area of 351,873 square miles it has, since the acquisition of Ungava, doubled its size to that of 703,653 square miles with 450,000,000 acres of which only 24,000,000 acres are cultivated and, in 1919, only 8,000,000 under field crops. Yet it is in area larger than Belgium, Holland, Germany, Austro-Hungary and Bulgaria before the war, Denmark and Sweden combined; without Ungava it would have the combined size of Germany, Holland, Belgium and Italy. As a whole its unknown but undoubted resources are enormous. Those which are fully known include forests which constitute one of the world's greatest timber reserves, with standing timber covering 130,000,000 acres and 32 pulp mills which lead in that great new element of production and have behind them an estimated 300,000,000 cords of spruce and balsam; cheap water-power along the course of the mighty St. Lawrence, in the Lake St. John and other regions which include 6,000,000 h.p. and a current development of 850,000 h.p.; abundant minerals of which asbestos—supplying 92 per cent. of the world's output—cement, copper, magnesite, marble and lesser products total $12,000,000 in annual value.

In agriculture the 2,003,000 people of Quebec produced $270,000,000 worth of field crops in 1918, with a dairying product of $65,000,000; yet its resources were only scratched and the settled fertile sections of the Eastern Townships alone can support twice their present agricultural population of 36 to the square mile. Much development work is being carried out under Government supervision and including new and excellent roads, great improvements in the St. Francis and other rivers, protection of fur-bearing animals, promotion of the cod and salmon fisheries of the St. Lawrence and Baie des Chaleurs, building of 5,000 miles of railway to date—partly Provincial and partly Dominion. The exports of the province (March 31, 1919) were $611,636,889— coming in part, of course, from the rest of the Dominion to the great seaport of Montreal—and its imports $248,559,052; its lumber product in 1916 was $13,726,630 and is steadily rising in values as the pulp-wood industry leaps upward; its bank clearings in 1919 were $6,595,339,437—the greatest of any Canadian Province.

Through the Gulf and 900 miles up the St. Lawrence from Belle Isle, salt water and sea touch the Province; in the far-off coasts of Hudson Strait, Hudson Bay and Ungava the Atlantic also washes the shores of Quebec; the province has countless lakes, many of which are river reservoirs, others expansions of the rivers, numbers of them famous for beauty and others for fish; the farming of Quebec is a combination of continental conditions with old-world customs and original French ideas and practices dating back to the days of Champlain; in their long narrow strips of land, the habitants of Quebec present a constant reminder of



THE GREAT QUEBEC BRIDGE OF THE CANADIAN NATIONAL RAILWAYS

the days when war and agriculture went hand in hand and life or death turned on the rapidity with which a pruning hook could be turned into a sword. On the picturesque and historical side of Quebec life little can be said here; its wide contrast with the flowing tide of English-American life on all sides of the people is attractive to every type of traveller and thinker; its traditions, simplicities, religious observances and faith, its political opinions and ideals, or adherence to language and customs, its ecclesiastical system and commercial expansion, its history and share in Canadian development, are all worthy of deep study and observation.

Quebec
Aug. 1

In a certain sense it all centres at Quebec City. Here, amid quaint old-fashioned streets and ancient churches and ruined walls going back to the foundations of French power and faith and hope in the New World, the traveller can touch the storied past with one hand and the comforts of a swift, modern civilization with the other. Situated at the confluence of the St. Charles and the St. Lawrence, built upon or around the base of a great elevation or cliff, connected by the C.P.R., Canadian National Railways and Grand Trunk with Montreal and the West, it receives ocean steamers and at the same time is connected up and down the great river by steamship lines with Montreal and the Saguenay, Gaspé and Charlottetown and Pictou while ferries to Levis, Sillery, St. Romuald and the Isle d'Orleans, carry visitors to most charming or interesting places and electric railways take them to Montmorency Falls, Ste-Anne de Beaupre, and other points of beauty and scenic note or religious traditional fame.

Founded in 1608 it is and always has been the capital of French Canada, and the Lower Canada of succeeding history, of the Quebec Province of today. It is the summer port of entry for Atlantic steamers and the landing place of immigrants; it has been the reception point for eminent visitors to Canada's shores and of Royal guests from the days when the Duke of Kent lived a little way down the river to those of later visits by the Prince of Wales (Edward VII) in 1860 and his son the Duke of York (George V) in 1891; the Prince of Wales (George V) at the great Tercentenary Celebration of 1908; or still another Prince of Wales in 1919—to the latter, however, it was a stepping-off place. This historic Rock of Quebec and its Citadel, or the fortifications which it has replaced, have experienced five sieges in which the future of half a continent was in great measure settled; as the military centre of the province in French days, its history is the history of French and English and Indian and American war; on the Heights of Abraham is the world-famous scene of Wolfe's victory over Montcalm and not far away upon the Cliffs, as they rise above the river, at this historic point is the place where Montgomery fell in leading the forces of the American Republic to the expected conquest of Quebec.

As the Provincial capital in British days, it was the pivot upon which turned many a policital contest, many a national issue, many important phases of provincial or religious or educational evolution. Quebec is the seat of Government and of the ecclesiastical administration of the province, with Cardinal Taschereau and Bégin as succeeding heads of the Church in recent years; it is the seat of Laval University, founded in 1852, of the ancient Seminary which dates from the earlier days of French power and of great ecclesiastical libraries and collections of historic paintings; it is the seat, also, of the Church of England Bishopric and a power which in the olden time was political as well as ecclesiastical; it was, until 1870, the home of British regiments and the nominal centre of British military power on this continent; it is the home of the beautiful terrace initiated by, and called after, Lord Dufferin which commands and adorns one of the most vivid scenes of natural beauty in the world today.

The City has 14 banks or branches of banks, 175 industries including especially that of boots and shoes, with also wood-working, tobacco, biscuits, clothing, corsets, furs, cotton mills, tanneries, lumber mills and wooden ship-building. The population is about 120,000, the tourist trade is an important one, the Quebec Bridge across the St. Lawrence seven miles above the City one of the sights for visitors to see. It is said to be the greatest undertaking of the kind in the world with a total length of 3,240 feet, a main span of 1,800 feet and of cantilever arms 1,030 feet: the clear height of steel work above high water is 150 feet and the weight of steel in the bridge 66,000 tons. With the completion of this important element in Transcontinental traffic, Quebec was brought into much closer connection with the Maritime and Prairie Provinces; its fine harbour and elevator and terminal

facilities were ready for a greater trade. Exports (March 31, 1919) were $9,650,803 and imports $19,360,110; its bank clearings in 1919 were $290,983,483.

Leaving Quebec City, the route to Montreal lies through a country possessing many and varied interests. Following the St. Charles valley and then, amid glorious scenery, gradually climbing the slope of the promontory, at the eastern extremity of which the capital sits, the train suddenly emerges upon the brow of Cap Rouge, where both a view of the St. Lawrence and of its famous bridge can be obtained. Turning gradually inland the route lies through a country rich in panoramic views of the long, narrow farms of the French habitants with their well-cultivated fields and neat little dwellings and outbuildings.

Grand'Mère
Aug. 2

Grand Mere, with its big paper mills and storage dam in the background and the rushing St. Maurice in the foreground, is touched at a point nearly 82 miles from Quebec, and ten miles further on Shawinigan, the famous centre of hydro-electric and industrial development is encountered. About 28 miles south of Alfred, and on the left-hand side of the train, are the picturesque Ste. Ursule Falls, tumbling from an enormous height to a deep canyon below. Being close to the track, they can be seen in detail even from a moving train. Passing through a delightful stretch of level country, dotted with pleasant farms typical of rural Quebec, the city of Joliette, a little over thirty-six miles from Montreal, is reached. Joliette is one of the important inland towns of the province. Paper mills are the most outstanding of its industries. Among others are woollen mills, saw and lumber mills, tobacco, clothing, biscuit and chemical factories. Its population is about 9,000.

At Joliette the trains transfer to the C.P.R. line, which takes them south to Lanoraie. The most important point is Terrebonne, where the north branch of the Ottawa River is crossed. Here are the limestone quarries which furnish most of the stone used in the neighbouring cities. St. Vincent de Paul is the site of the Quebec provincial penitentiary. The line turns south at St. Martin Junction crosses the Back River at Bordeaux and arrives at the C.P.R. Windsor Street Station at Montreal.

There is another route from Levis (opposite Quebec) to Montreal, on the south side of the St. Lawrence River. Levis has one of the 20 classical colleges (200 students) which, throughout the Province, afford such excellent training along lines of French culture; it has a number of industries including an important shipyard and is a very important railway centre. This route is through the Eastern Townships, a belt of English population interjected into the mass of French population by pioneer immigration and succeeding settlement from the days of the United Empire Loyalists to the English and Irish migrations of the middle of last century. The principal city is Sherbrooke, a flourishing industrial centre of 23,000 people. It has 25 wholesale houses and 40 industries. There are asbestos mines and copper mines in the district. Pulp mills are located at Brompton and East Angus. Another prosperous city is St. Hyacinthe (36 miles from Montreal), with a population of 12,000. Other places on this route are Richmond, population 2,300; Bedford, 1,200; Coaticook, 3,300; Farnham, 4,000; Magog, 5,000; Waterloo, 2,000.

Montreal
Aug. 2-3-4

In size, in wealth, in population, in commerce, in the vigour and charm of its history, in scenery and situation, Montreal stands high amongst the cities of the American continent. It is located on an island, 32 miles long and from four to eight miles wide, at the confluence of the St. Lawrence and the Ottawa; its spacious harbour, though 1,000 miles from the ocean, can be reached with safety and facility and includes about eight miles of deep water and wharfage with berths for 92 vessels; its latitude of 45° 30′ 17″, or about the same as that of Venice, and its climate, though cold in winter, is healthy and bracing; it is the seat of Anglican and Roman Catholic Cathedrals and of a vivid religious history, embodying much of the militant faith and powerful influences of Catholicism upon the fate of a race and the annals of this continent; it is the home of McGill University, founded in 1821, and developed into the greatest, in some respects, of Canada's institutions of learning, with a teaching staff of 254 and students ranging from 1,300 in a war-year to 3,000 in time of peace; it is also the seat of Laval University, organized in 1852, with affiliated Catholic Colleges all over the Province, with 304 teachers and 3,300 students, with great influence over the culture and training of French life and the

progress and strength of its church, with, also, in 1920, re-organization as the Université de Montreal and a fresh endowment, popularly subscribed, running into millions.

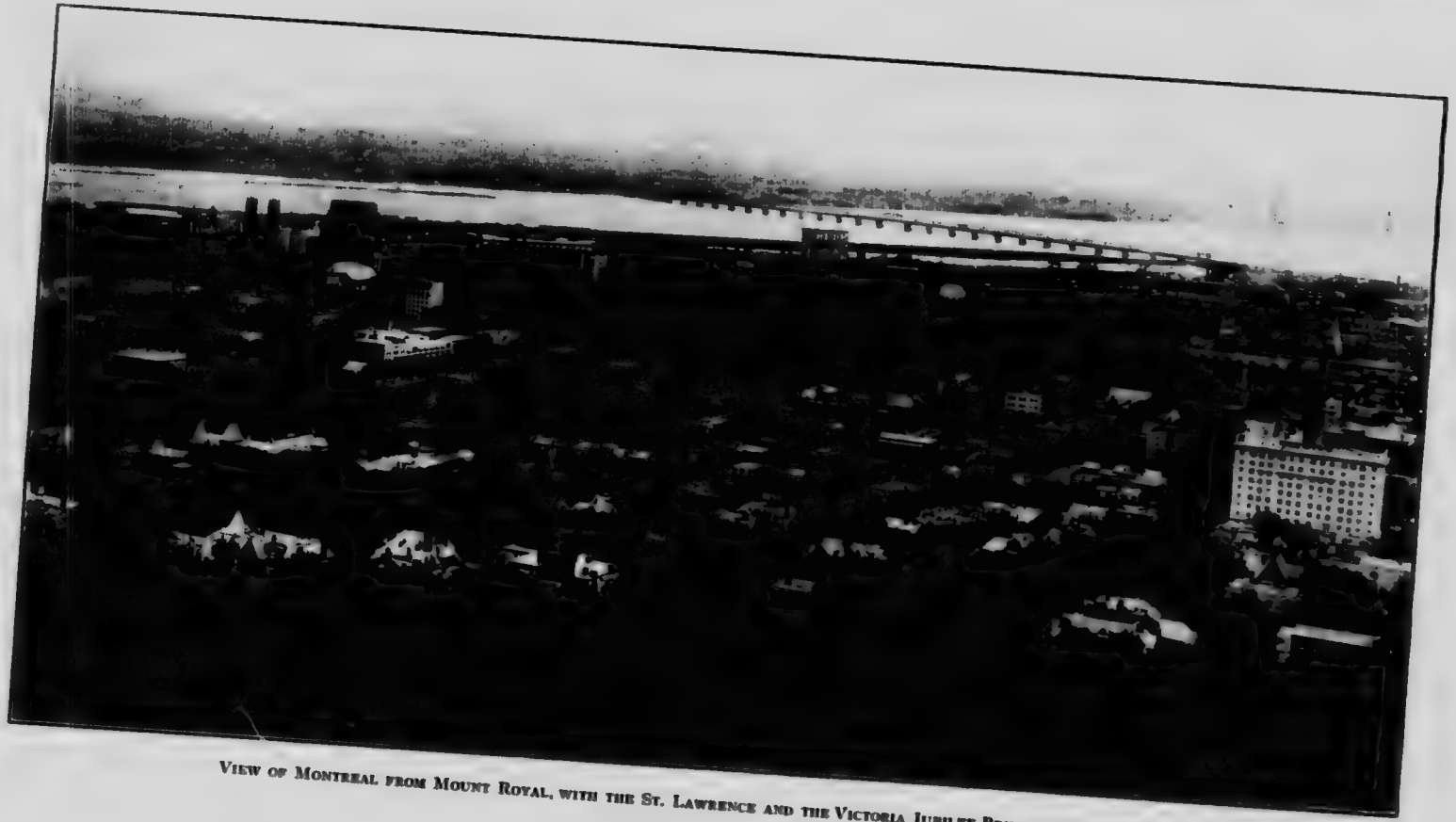
Montreal is a great railway centre with the G.T.R., C.P.R., Canadian National Railways and a number of minor lines connecting it closely with the trade of Canada and the business of the United States; its splendid electric power supply comes from Shawinigan Falls, also a great industrial centre, Lachine Rapids and Chambly Rapids; it includes over 1,400 factories with boots and shoes, clothing, sugar-refining, flour mills, cement, tobacco, rubber, iron and steel machinery, tools, silk, cotton, woollens, paints, furniture, carriages, electric goods and confectionery amongst the chief. Its bank clearings in 1918 were $4,833,000,000 and in 1919 $6,254,000,000; its taxable property is valued at $623,000,000 and the amount exempt from taxation is $226,000,000; it had 644 ocean vessels entering its port in 1919, with a total tonnage of $1,960.63; its exports (March 31st, 1919) were $396,976,260, and imports $186,135,834; its shipments by water in 1918 included 59,826,197 bushels of grain, 7,419,000 sacks of flour, 116,398 bales of hay, 1,754,193 boxes of cheese; its customs revenue was $35,000,000 in 1918, and 6,102 inland vessels arrived with a tonnage of 3,318,000; its population is 685,000 or, with outskirts, 775,000.

This city is the meeting-place for lake and ocean vessels, the terminal point and outlet of the vast body of waters connected with the St. Lawrence, the headquarters for many years of the Canadian Pacific, the Grand Trunk and the Grand Trunk Pacific with their 30,000 miles of line in Canada and the United States; it is the centre of a commercial and distributing area which includes a number of American States as well as Canadian Provinces, the home of great car-shops and many of the greatest manufacturing plants of Canada—the latter being aided by its central situtation, cheap and abundant electric power, facilities for bringing in coal from the Atlantic Provinces and the United States, a plentiful labour supply and comparatively peaceful relations between employers and workmen. Its harbour is of great importance and is controlled by a Board appointed by the Dominion Government with $25,000,000 expended in modern improvements and $9,000,000 more voted by Parliament in 1914 as a loan for the same purpose. In 1914 it became the greatest grain port in all America with 75,085,432 bushels of grain handled as against 64,582,190 by New York: its growth in shipping has been remarkable with an increase in tonnage from 4,725,607 tons in 1905 to 9,044,457 tons in 1914—in the latter year its tonnage of inland vessels arriving was 6,288,939 and the number 12,225, while from the Maritime Provinces came 365 vessels of 716,385 tons.

As a central point of Canadian history, as the home of religious traditions and the seat of power for a great church, it has many interests in addition to its commercial progress and financial influence. Founded on May 18, 1642, by Paul de Chomedy, Sieur de Maisonneuve, a soldier of noble character and deep religious feeling, as a hoped-for centre of godly activity and religious extension, it was surrounded and influenced through all its early history by a similar strain of thought. The bitter conflict of life and death with Indians or the English, with colonists from the Atlantic coasts or Americans of a latter date, might go on from time to time, but ever present in the men of that day was devotion to their church together with a sacrificial spirit shown by the women which is abundantly illustrated in the history of its convents and educational institutions.

Out from Montreal, also, in these earlier years poured a stream of explorers—Joliet, Hennepin, La Salle and Dulhut—who searched the trackless paths of forest and wilderness and great waters far down in the United States of another century; a procession of adventurous fur-hunters who traversed similar regions north and westward and established Montreal as the great fur-trading centre of the continent with Fort Frontenac—afterwards Kingston—as its western outpost. Laid out and organized and with streets named in 1672, it was, 50 years later, provided with fortified walls and bastions by De Léry, a great French engineer—though not a trace of them remains today. It was the scene of a great Indian peace conference in 1701, with savages present from many parts of the continent; on the slopes of Mount Royal surrender was made on September 7, 1760, to General Amherst; here for a brief time in 1775-7 the continental armies of Washington held sway and Benjamin Franklin founded the "Gazette," a sturdy British paper of later days; here, in after years of peace, commerce and trade became supreme in English-speaking circles.

But everywhere, in narrow streets and style of architecture, in language and customs, the French race was and is in evidence; everywhere the influence of the



VIEW OF MONTREAL FROM MOUNT ROYAL, WITH THE ST. LAWRENCE AND THE VICTORIA JUBILEE BRIDGE IN THE DISTANCE

church of its people is obvious. Great monastic buildings and schools and convents and churches can be visited as in some old European city—the Notre Dame Church with its lofty towers and beautiful chimes which is said to be the largest on the continent after the Cathedral of Mexico, and built on the model of Notre Dame in Paris, to accommodate 15,000 people; the Cathedral of St. James, a facsimile of St. Peter's at Rome, the Hôtel Dieu Hospital, the ancient Seminary of St. Sulpice, built over two centuries ago, the old-time Church of Notre Dame de Lourdes, the Jesuits' Church in Bleury Street with its exquisite frescoes, the Chapel of Notre Dame de Nazareth with its fine paintings, the ancient Bonsecours Church, founded in 1771, the famous Grey Nunnery, originally built in 1738. Other buildings of interest and importance are the structures constituting McGill University, the historic Bank of Montreal, the castellated pile of the Canadian Pacific Windsor Station, Christ Church (Anglican) Cathedral, an almost perfect specimen of Gothic architecture, the Redpath Museum, the Royal Victoria Hospital, the Chateau de Ramezay with its splendid collection of French-Canadian antiquities.

The C.N.R. tunnel through Mount Royal into the heart of the city is one of the notable sights of Montreal. It was a great enterprise, completed in September, 1918, and consists of twin tubes of reinforced concrete construction, which rise by an easy grade of 31.6 feet to the mile to the outer or western portal at Mount Royal. From the summit of the mountain to the tubes the depth is about 600 feet, while the length of the tunnel is 3.25 miles.

Many of the most interesting points are to be found only by those who search. As one writer puts it:

"Squeezed in among the outbuildings of busy factories and great modern warehouses are to be found some of the modest but massively built residences of the French régime, with their generous, open fireplaces and elaborately ornamented mantels, built as long ago as 1680. In Vaudreuil Lane still stands the modest old warehouse where John Jacob Astor, in the palmy days of the Montreal fur trade, laid the foundation of the Astor millions. Quaint old Roman Catholic chapels and convents exists in the very centre of blocks which, at a cursory glance, are given up to 20th century commercial activity; as quaint and sweet a monastery garden as existed in 14th century Europe flourishes within easy stone's throw of the Montreal Stock Exchange."

The first bridge to span the St. Lawrence at Montreal was the Victoria Bridge which at one time was called the "8th wonder of the world." Producted by the genius of Robert Stephenson and formally opened by the Prince of Wales (King Edward VII) in 1860, it has a length of almost two miles and constituted a vast tube supported on 24 piers and great terminal abutments. It was remodelled and rebuilt by the Grand Trunk at the close of the century for a city which had grown from 60,000 to 350,000 in population. Not far away, at Lachine, the C.P.R. has built an open-work cantilever steel bridge with spans looking like "clusters of great steel cobwebs." All around Montreal are places and scenes of interest, of special beauty, of historic charm and memory.

Ste. Anne's
Aug. 4

Passing from Montreal the main goes through various suburbs or practical continuations of the City. A number of small villages—Dorval, Valois, Beaconsfield, etc., are passed until Ste. Anne de Bellevue, 20 miles from Montreal, is reached. It is a peaceful spot with fine summer homes and famous for its fishing grounds of maskinonge and black bass, but in early days of French settlement it was the scene of many stirring and stormy events; here 100 years ago lived for a time, Tom Moore, the poet, and here he composed his celebrated Canadian Boat Song.

Macdonald College, affiliated with McGill University, and teaching scientific agriculture, domestic science and education to over 500 students, is located here. Over seven million dollars has been invested in this highly influential institution. At Ste. Anne also is an extensive hospital for treatment of returned soldiers. Further north of the line is Senneville, noted for its summer homes. The western arm of the great Ottawa River is crossed at this point and Vaudreuil, an historic village of a thousand memories is reached. It is located on the G.T.R. as well as the C.P.R. with 20 trains leaving daily for Montreal, and has a great reputation for thoroughbred stock and large shipments of milk and cream, hay and grains; there is abundance of good fishing, boating and shooting.

The trains skirt the margin of the Lake of the Two Mountains—an expansion

of the Ottawa River—for a distance of ten miles and pretty watering places such as Como, Hudson and Hudson Heights, are passed. To the right of Rigaud is the Rigaud Mountain, an eminence near whose summit is a curious deposit of small rounded boulders, covering an acre or two—a bare and desolate spot, surrounded by luxurious vegetation—which legend gives the name of Devil's Playground. Shortly before arriving at St. Eugene the Province of Ontario is entered.

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THE PROVINCE OF ONTARIO

Ontario: A Canadian Centre of Industry, Agriculture and Progress

Rich in its history and traditions, its farms and minerals, its cities and industries, its resources and development, its political liberties and inheritances, Ontario is a field for much interesting study and attractive analysis. Founded by British Loyalists, and living beside the United States and its overwhelming mass of population, British in sentiment and American in many of its customs and practices, the province and its people present some settled in prosperous farming communities and established rather bewildering contrasts. With an older region industrial centres; with a new section, a vast Northland full of riches in mines and forests and soil and pregnant in opportunities of development; with an estimated 2,750,000 of population and an area of 407,262 square miles of which 365,888 square miles are land—a total territory as large as France and Germany, before the war, combined; with a total industrial product in 1917 of $1,533,738,655 and farm values in 1916 (land, buildings, implements and live-stock) of $1,513,880,550; with a climate of varied nature extending between the latitudes of Madrid and Aberdeen and producing crops which run from the grapes and peaches of Niagara to the clover seed, potatoes and turnips of the Northern clay-belt and its 15,000,000 acres of rich, virgin soil; Ontario has seen a great development and has a much greater in store.

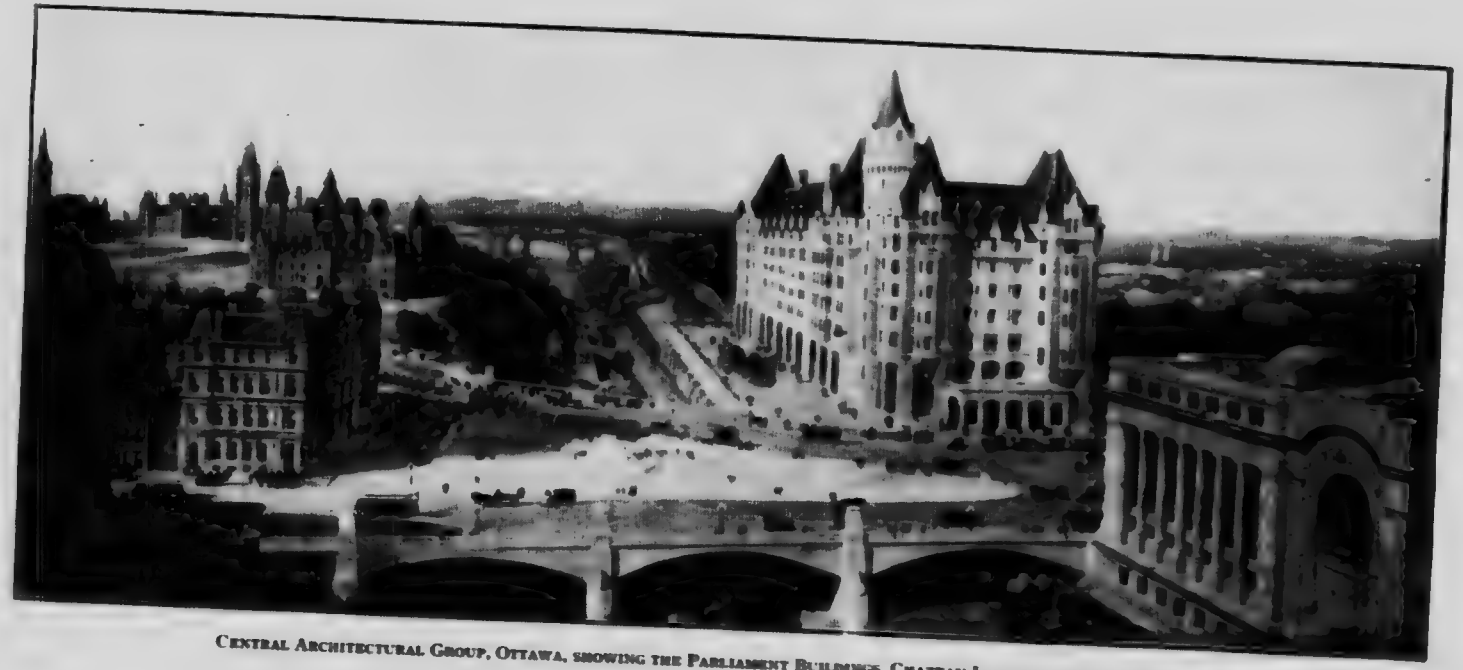
Ninety per cent of the population is concentrated in what is popularly known as old Ontario, within the peninsula bounded by the French River, Lake Nipissing and a chain of smaller lakes, the Ottawa River, the St. Lawrence and Lakes Ontario, Erie and Huron—a district with a land area about the size of England; the remainder of the province is generally termed New Ontario. The southern counties rival the Annapolis Valley of Nova Scotia in their production of apples, peaches, pears, plums and the finest grapes and, though much grain is still produced in the province—wheat in 1918 to the value of $31,401,000, oats $102,212,000, barley $25,809,000 and mixed grains $29,823,000—the farmers are turning more and more to fruit and dairy farming. There are more than 300,000 acres under fruit and probably $80,000,000 invested in the industry; there are over 50 Co-operative Fruit Growers' Associations and the approximate annual production of wine is 275,000 gallons; under normal conditions Ontario exports more apples to Great Britain than any other province or state on the Continent while the eastern provinces purchase 1,000,000 bushels annually from this Province; the estimated yearly output of peaches is 22,000,000 quarts. In cheese Ontario has led the world for many years, its average annual production in 1900-1914 being 136,000,000 pounds; the value of its live-stock was in 1917 $289,676,000 and its cheese and butter product $36,200,000.

Almost every mineral except tin and coal is to be found in Ontario with nickel, silver, gold, copper, iron and natural gas as the most important in their product to date and with promising results in mica, graphite, talc, corundum, granite, marble, feldspar, pyrites, gypsum, zinc and molybdenum; the total production in 1918 was $94,694,000 or more than twice that of any other province; the Sudbury nickel mines are recognized as the world's richest, with a product of $8,262,000 in 1918, the gold of Porcupine promises enormous results and the Hollinger Mine is already one of the greatest in the world; the silver of Cobalt has totalled (in 1904-18) a shipment of $109,377,000 worth. Of the immense total of available water-power in the province, estimated at 5,800,000 h.p., 985,000 h.p. has been developed with Niagara Falls as the centre of a great hydro-electric system which is supported by Government and people.

There has been an expenditure of $50,000,000 and probably twice that amount will yet be expended but the return has been very great in the production of what is termed "white coal," in the running of industries, in the provision and cheapening of light and heat, in the initiation of motive power for big things and small—railways and factories, kitchens and fields. It is estimated that 100,000 square miles of forest land remain as a permanent source of wealth; the large water areas make fishing a valuable commercial industry, and ever-present source of sport. The trade of Ontario (March 31, 1919) totalled $298,270,478 in exports and $470,650,679 in imports; its bank clearings were $5,479,295,000 in 1919.

Ottawa Aug. 4-7

Founded in 1817-18 Ottawa, in its hundred years of history, has passed from a favourite stamping ground of Indians, a region of dense forests and a wilderness of waters, to be one of the noted capitals of the Empire and the best known of the newer nation centres. It is



CENTRAL ARCHITECTURAL GROUP, OTTAWA, SHOWING THE PARLIAMENT BUILDINGS, CHATEAU LAURIER AND UNION STATION.

picturesquely situated at the junction of the Rideau and the Ottawa Rivers and within sight and sound of the Chaudière Falls which afford scenic interest as well as electric power for a host of saw-mills and factories; it has always been a lumbering centre and vast quantities of logs are floated down the Ottawa and its tributaries to the mills and made into lumber and other manufactured forms. Historically Ottawa owed its real beginnings to the Rideau Canal, built by the Imperial Government in 1826-33, to connect the waters of Lake Ontario and the St. Lawrence via the Ottawa River and the Rideau River and Lakes, and chiefly for military purposes. The corner-stone of the locks was laid in 1827 by Sir John Franklin and the chief engineer was Colonel By, R.E., who selected the site of the future capital as headquarters for himself and staff and there, the village of Bytown gradually grew with, in 1833, about 130 homes in the settlement. In 1854 Bytown with a population of 10,000 was incorporated as the City of Ottawa and in 1857, by selection of Queen Victoria, it became the permanent capital of the United Provinces of Upper and Lower Canada.

The Parliament Buildings are the central attraction for visitors and are erected upon the most important and picturesque site in the Capital; they were first opened by the Prince of Wales (King Edward VII) in 1860 and, after the fire of 1916, were rebuilt at a cost of $7,000,000 and reopened by the present Prince of Wales in 1919. Rideau Hall, the present Government House, is an inartistic but interesting pile of old buildings which the residence of all the Governors-General since Confederation has made a part of Canadian history; the Parliamentary Library, the National Victoria Museum, the National Art Gallery, the Royal Farm, are other places of established attraction. The Chateau Laurier, at Ottawa, is owned and operated by the Grand Trunk System.

Ottawa is the seat of Catholic and Anglican Archbishoprics with Cathedrals and other distinguished Church buildings; it has the Ottawa University, a Roman Catholic institution and several lesser Colleges; its driveway extends 30 miles and is well laid out with a beautiful 2,000-acre park, it has 180 factories with a capital of $50,000,000 and employing 17,000 persons. They include wood products, paper mills, match works, foundries, cements, carbide, marine gas buoys, iron works, clothing, etc. The bank clearings were $472,691,921 in 1919. The population is about 100,000.

The run from Ottawa to Toronto is made by night, the trains passing through one of the most thickly-populated parts of Canada. Among the important places on the line are: Smith's Falls, a railway junction, population 7,000, with important industries; Perth, population 4,500, a manufacturing town in the centre of a fine farming country; Belleville, population 12,000, a thriving manufacturing city situated in the Bay of Quinte; Trenton, population 5,000, seat of an extensive lumber and milling industry; Cobourg, population 5,000, busy grain exporting town and popular summer resort; Port Hope, a pretty town of 5,000 people, possessing one of the best harbours on the lake; Bowmanville, population 3,500, centre of a rich farming country; Oshawa, population 9,000, a splendid manufacturing centre and one of the most progressive towns in Ontario. Between Ottawa and Toronto, although not on this particular route, is Peterborough, one of Ontario's cities and a very busy place of 24,000 population. Situated on the Otonabee River, which at this point falls 150 feet in a few miles and affords immense water-power, it is essentially an industrial centre. Here are located the immense works of the Canadian General Electric Co. and the Canadian Quaker Oats Co. This city was the birthplace of the famous Peterborough or Rice Lake canoe. Another town is Renfrew, an industrial centre of 6,600 people; Pembroke, population 8,500, lumbering and industrial centre ten miles from which is the Dominion military camp of Petawawa, where so many troops for the war were trained, and 169 miles west is the Algonquin Provincial Park with its splendid scenery, big game, trout-fishing and fine bracing climate.

Arriving at Toronto, the capital of the Province of Ontario, the party transfers immediately to the boat which crosses Lake Ontario and proceeds up the Niagara River to Queenston, and therefore the Queen City of the Dominion will be described later.

Queenston
Aug. 8

The boat trip from Toronto to Queenston across Lake Ontario and up the Niagara River, is itself, a delightful experience. When to the beautiful view of the high, green-clad ridges of the river with historic Niagara ports either side of the entrance—one British and the other American—are added the thrill of grandeur afforded by the railway route along the upper part of the river in order to see t[illegible]ds and



NIAGARA FALLS

reach the falls, the tourist has an experience as full of pleasure and of awe as natural scenery can give. The first impression is that of the historic village of Niagara-on-the-Lake, at the mouth of the river, where Indians and whites, French and British, Americans and Canadians once contended for the supremacy of the lake regions and where every foot of soil is sacred ground. In the neighbourhood are the ruins of ramparts and a fort once held by British troops; not far away is the battlefield of Lundy's Lane, where British and American forces fought for hours; here the first Parliament of Upper Canada was held in 1792 under the shade of a spreading oak. Prominent in the view from the lake and river is the Queen's Royal Hotel; the country all around is a veritable garden.

From the entrance up to Queenston the river runs for seven miles between high, wooded banks crowned by gardens and comfortable homes and backed, on the Canadian side, by the rich vineyards and fruit farms of the Niagara peninsula. Opposite Queenston is Lewiston, N.Y., on the American side. Historic Queenston Heights is crowned by the famous Brock Munument of 190 feet—higher than Nelson's Column in Trafalgar Square. It was erected in 1824, blown up by Fenian instigation in 1840, and rebuilt by militia and Indian subscriptions. At the top of the lofty stone shaft is a statue of Sir Isaac Brock, the hero of the Queenston battle and the saviour of Canada from the United States invasion in 1812. He was killed in storming the Heights, which had been captured by American forces, and he left to his successor the task of actually driving the enemy into the river.

Following the river by trolley along the cliffs, the tourist traverses the Great Gorge route. A real description of the scene requires poetic insight and dramatic power. As the train rushes or creeps along the varied grades of the line the river narrows into a gorge, the water appears to cease flowing and leaps and dashes upward and around as if impelled by volcanic forces; the dark front of rock frowns into the storming depths and the train goes steadily on, while lesser whirlpools indicate dynamic forces of lesser weight. The approach to the Falls is still splendid and, despite the outpouring of water on the rocky sides from many factories and a general commercializing of its surroundings, there is enough to indicate the awe-inspiring nature of the scene when the thunder of the great waters was heard and their majesty witnessed from dense and sombre forests shrouding the lofty sides of the river, and only the myriad noises of wild life to echo back the wild roar of the torrent, as it poured 158 feet (on the Canadian side) over a great perpendicular ledge.

Of the two Falls, the Canadian is by far the greater, with 93 per cent. of the water rolling over its cliffs; as to both, the perimeter is now estimated at 3,400 feet where 20 years ago it was 4,900 feet. As a matter of theory and commercial development, the water in the Falls and the rapids above and below should yield 8,000,000 horse-power; practically, and for various reasons, it is not much more than 6,000,000 h.p. The Boundary Waters Treaty between Canada, Britain and the United States limits the amount of water-power to be diverted to 20,000 cubic feet per second for the United States and 36,000 for Canada; 29,500 cubic feet of the Canadian portion is now under development and the balance is promised for the pending operations of the Ontario Hydro-Electric Commission. The estimated total power development obtainable at Niagara without impairing the beauty of the Falls is 2,500,000 h.p., which is said to be equivalent to 16,000,000 tons of coal per annum. It may be added that between June 1st and October 1st the Falls are illuminated by electric light and that the spectacle is of a most weird and impressive nature.

Niagara Falls
Aug. 8-9

Around the Falls, on the Canadian side, is the Queen Victoria Park, a provincially-owned pleasure resort, with its own system of boulevards and driveways, and with the Clifton House nearby. On the river are the great power works of the Electrical Development Company and Canadian Niagara Company, private concerns, as well as the publicly-owned Ontario Power Company, which is operated by the Hydro-Electric Commission, a provincial enterprise. The Chippewa Canal, one of the world's greatest power-development enterprises, is being constructed by the Ontario Hydro Commission, and is a Niagara attraction which no tourist should miss. From the Falls to Grimsby and through the Niagara Peninsula to Toronto is a trip of most interesting character—scenic and creative, natural and industrial. As the G.T.R. train passes from Niagara Falls—a town of 11,000 population on the Canadian side and a still larger centre of the same name on the United States side in the State of New York—it touches the fringe of a great industrial develop-



THE HEART OF TORONTO'S BUSINESS DISTRICT, SAID TO BE THE BUSIEST CORNER IN CANADA

ment which the electric energy of Niagara has helped all over Western Ontario. The Ontario town is a railway centre, touched by 12 railways, and with numerous manufactures which include cereal foods, carborundum and cyanamid, suspenders and neckwear, wire and steel chain, silverware, hats, hosiery, carpet sweepers, paper boxes, automobile accessories, aluminum novelties, corsets, sanitary cans, cranes and hoists, electro-chemical supplies, etc.

Merriton is the first stop in the fruit country—a town of 2,500 persons on the banks of the Welland Canal, which makes connection between Lakes Ontario and Erie possible around and despite the torrents of the Niagara. Then comes St. Catharines, the heart of the fruit belt, a city of 19,000 people, founded about 1797. It has electric railway connection with the Falls and other Peninsula points, 12 banks, 15 churches and 10 schools; it has abundant electric light developed from the Falls, is the seat of Bishop Ridley College (Anglican), the capital of Lincoln County and controls about 80 industries, including paper, flour, flax, silk and planing mills, four canning factories, hair-cloth, wine, metal and motor works, electrical machinery, incandescent lamps, baskets, saws, hand-tools, mince-meat, jam, knives, rubber. Its mineral springs are considered good for rheumatism.

Grimsby
Aug. 9

The village of Beamsville and the summer resort of Grimsby Beach follow. Grimsby, itself, is 18 miles east of Hamilton, a great industrial centre, and 18 miles west of St. Catharines. It is on the shores of Lake Ontario, with a population of about 1,800, industries which include canneries, planing mills, printing works, basket factories, furniture, etc. The trips from Grimsby to Hamilton is by motor through the wonderful Niagara Garden. Winona and Stoney Creek—the scene of one of the few British defeats on Canadian soil during the war of 1812—follow and then Hamilton is reached.

Hamilton
Aug. 9

A finely situated, prosperous and ambitious centre of Canadian life and industry is Hamilton. It is on an excellent harbour at the western end of Lake Ontario, and surrounded by a rich and fruitful country; it has splendid shipping facilities by rail and water with the G.T.R., C.P.R., Toronto, Hamilton and Buffalo meeting here, an electric railway running to Grimsby, Brantford, Oakville and Dundas and steamship lines to Montreal, Fort William and Toronto; it has cheap power from Niagara and the local power of the Cataract Power Co. and the Natural Gas Co.; its population is 108,000, assessment $93,682,000, bank clearings in 1919 $306,000,000. Its chief hotel is the Royal Connaught and it has about 30 others with over 80 churches, 33 bank branches, 38 public and separate schools and 10 private or business institutions; it has a normal school and two technical schools and three public libraries and a new General Hospital.

Founded about 1810 Hamilton has, in recent years, proved very attractive for American capital in its industries and the Westinghouse, McCormick and Firestone firms indicate the character of this investment; 32 new industries in 1919 with a capital of $10,000,000 show the growing prosperity of the city in this connection. There are over 500 industrial establishments in Hamilton including steel, iron, cotton and woollen goods, boots, furniture, ploughs, stoves, automobiles, store fixings, clothing, electrical wires and cables, agricultural machinery, cigars, and cigarettes, etc.

The trip from Hamilton to Toronto is made on the "Hamilton-Toronto Highway" a stretch of 40 miles of asphalt pavement motor road. Skirting the Bay the route is through Burlington, Bronte to Oakville, a town of 2,900 people with a number of handsome residences and many summer homes of Toronto people. Succeeding points which bring the party into Toronto are Clarksons, Lorne Park, Port Credit, the Rifle Ranges, Long Branch, Mimico, the Humber river, High Park and Sunnyside.

Toronto
Aug. 9-11

The capital of the Province of Ontario, the leader of Canadian life and thought in many directions, the centre of Ontario's history and politics, commerce and finance, literature and journalism, Toronto was founded in 1793 by Colonel John Graves Simcoe, Lieut.-Governor of Upper Canada, with a view to security from possible American hostilities. It was originally called York after H.R.H. the Duke of York, and, popularly, "Little York" to distinguish it from the Cathedral City of England; it retained this name until 1834 when incorporation gave it the Indian

name of Toronto signifying "place of meeting." During the war of 1812, when the Americans twice captured Toronto, it did not have more than 900 inhabitants; a century later it possessed a population of 450,000 and today with legitimate suburbs it approaches 600,000.

It has always been the capital of the Province—as Upper Canada, Canada West or Ontario—and is the seat of Government House, a palatial building in the Rosedale suburb, costing millions, and well fitted for lavish hospitality. It is the seat of the Roman Catholic Cathedral of St. Michael and the Anglican St. James Cathedral which latter, technically, is superseded by the unfinished St. Alban's structure in the northern part of the city. St. James is an historic building of perpendicular Gothic design with a spire of 316 feet which is said to be, with one exception, the loftiest on the continent.

The University of Toronto takes high place among the highest. Founded 1827 it is affiliated with Oxford, Cambridge and Dublin, it has a normal staff of 400 and students numbering 4,000, its endowments total $7,000,000 and the value of its land and buildings is about $6,000,000. The main University structure—there are many minor buildings—is one of the finest pieces of college architecture on the continent with Norman design, a square central tower of noble proportions and a deep carved porch famous for solidity and richness. Not far from the University buildings is the Parliament House of the Province—a massive block of masonry; near to it on Bloor Street is McMaster University, a Baptist institution, and a handsome structure of brown stone, faced with red brick. Queen's Park, opposite and around the Parliament Buildings, forms a spacious resort with historic statues and well-known residences encircling it. In this vicinity are also Hart House, associated with the University, and the Ontario Museum.

Down town, on Queen Street, is the Metropolitan (Methodist) Church with an organ which was for long the largest in Canada containing 3,315 pipes and 53 stops. Osgoode Hall, named after the first Chief Justice of Upper Canada, is the seat of the Courts, the Law Society and Law School and was once compared by Anthony Trollope to the Four Courts of Dublin. Other institutions of the city are the Reference Library on College St., the Art Museum once known as "The Grange" and the home of Goldwin Smith, the Normal School, and the skyscraper buildings of the C.P.R., the Dominion Bank and the Royal Bank of Canada. Toronto has a most complete railway system, reaching out to every important place and district in the Province. The Canadian Pacific, Grand Trunk and Canadian National Railways radiate from here in all directions, and on Lake Ontario many fine trips can be taken by steamer, including a visit to Niagara Falls, via Queenston or Lewiston, and trolley car. Railway lines connect here to all important centres on the continent. Three run to Muskoka Lakes and others to the Timiskaming district with its wonderful lake and river fishing and big game shooting, or to Cobalt and Porcupine with their great silver and gold mines.

Toronto's bank clearings in 1919 were $4,251,644,000. Its constantly growing trade has received a new impetus through the establishment on its central water-front of a great industrial area of 1,000 acres by the Harbour Commission, with splendid water and rail advantages. The city has more than 1,200 factories and a few of the more notable industries are foundries, wood products, leather, clothing, agricultural implements, automobiles; there are 78,000 men engaged in these factories with a pay-roll of $40,000,000 and the capital invested is $170,000,000. The land area of the city is 32 square miles, its assessment (1919) $621,051,064, and rate of taxation 28½ mills, its gross debt on December 31, 1919, was 102 million dollars and its net debt 42 millions; its street railways in that year carried 210 million persons.

Toronto has been called the "City of Churches" and has over 200 within its limits; its residential districts, especially Rosedale and streets on the hill north of the city are noted for beautiful homes and spacious grounds; it is not only the educational centre of the Province by virtue of its Government-supported university and affiliated institutions—Trinity, Victoria, St. Michael's and other colleges—but because of its 131 public and separate (Catholic) schools, 10 high schools and such institutions as Upper Canada College and St. Andrew's College; it is distinguished for love of music and the Mendelssohn Choir is known all over the continent, while one of the several large conservatories of music has 2,000 students enrolled. Around the city are all kinds of summer resorts and drives—the Rosedale Ravine, the Humber and Don River Valleys being notable; the island across the bay has cool and pleasant popular parks and the Royal Canadian Yacht Club is a delightful private resort.

Guelph
August 11

The route from Toronto to Guelph, by Grand Trunk, is through a fine agricultural country and Brampton and Georgetown are the chief towns with villages en route, which include Weston, Malton, Norval, Acton, Limehouse and Rockwood. Brampton has a population of about 4,000 with six churches and three banks, and, like most places of this size in Ontario, it has a high and public schools, a public library, a municipal ownership of electric light and waterworks. The industries include five cut-flower conservatories, three boot and shoe factories, paper boxes, hosiery, loose-leaf factory, knitted goods, four planing and flour mills, furnaces, gummed paper, pressed brick; it is also the centre of a rich dairying and apple-growing district and it is a large horse, cattle and hog distribution point. Georgetown, on the Credit River, has a small population and five churches; its industries include gloves, woollens, knitting machines, castings, carriages, etc.; the scenery is charming. There is a Country Club and fine trout-fishing.

The city of Guelph is 48 miles west of Toronto and 182 from Detroit, Michigan; it was founded in 1827 by John Galt, became a city in 1879; it has 16 churches and 18 schools and an estimated population, with suburbs, of 20,000. The city owns all its utilities—gas works, electric light, waterworks, radial railway and the Guelph Junction Railway; it is the home of the Provincial Winter Fair and Fat Stock Show which about 40,000 farmers visit every December and which includes a splendid sheep show, the best Clydesdale show on the continent and the largest and best poultry show in Canada; Niagara Hydro-Electric power is supplied at $19 per horse-power. Guelph is a flourishing town, the capital and centre of the county of Wellington and is built of limestone on a series of hills around which the River Speed winds; its climate is notably healthy and the site is 1,143 feet above sea-level; it has eight parks and a particularly active Horticultural Society which looks after them and the task of beautifying the city.

The Ontario Agricultural College is the pivotal institution of the place. Founded in 1874 by the Ontario Government and supported as a provincial institution, it now has over 50 teachers and 1,200 students: its courses cover all forms of agricultural science and practice, domestic science and manual training; its degrees of B.S.A., obtained after a four years' course, is highly respected, while an associate diploma is given young men after two years' instruction in practical farm work; the Macdonald Institute, which owes its building and endowment to Sir W. C. Macdonald of Montreal, gives a three-month course to young women in cooking, sewing and laundry work, a home-maker course of one year and two years to professional housekeepers and teachers of domestic science; it gives short courses during the winter months to farmers in stock judging, seed judging, horticulture dairying and poultry husbandry.

Guelph is a noted centre for grey iron castings which it supplies to the trade throughout Canada; it possesses the only linen mill in the Dominion and over 90 different manufacturing establishments. These include automobile tires, rubber footwear, radiators, boilers, gas engines, men's hats, sewing machines, pianos, carpets, carriages, clothing, steel and wire goods, wrought-iron and steel tubings, agricultural implements, steel axles and springs, machinery and motor cars . There is a rich agricultural country all around and excellent trout fishing in the vicinity.

Western Ontario

The journey from Guelph to Sarnia, by G.T.R., touches some of the most prosperous farming and industrial sections of all Ontario. After leaving Guelph and passing through Mosborough and Breslau, a splendid agricultural region and the heart of the old-time German settlements, at Kitchener—before the war known as Berlin—is reached. This city, with a population of 22,500, and Waterloo, with 5,000, are contiguous and practically one—though separate in their municipal government; nearby are the little manufacturing towns of Preston (5,000) and Hespeler (3,000) with the large industrial centre of Galt (12,000). Kitchener, which is noted for its manufactures, is situated near the Grand River and is the county seat. It has 135 factories and a yearly output of about $40,000,000; its imports are $6,588,366 (1919) and bank clearings $48,244,693; it has 18 churches and seven public schools with other educational institutions, three hospitals and eleven banks.

It owns and operates all public utilities—street railway, water, gas, electric light, etc. The industries include furniture, automobile tires, rubber footwear, machinery, shirts, collars and cuffs, gasoline engines, vacuum cleaners, phonographs, boots and shoes, felt footwear, buttons, trunks, clocks, baby carriages,

ladders, toys, bicycles, etc. Waterloo supplements these with many of the same kind and brooms, threshing machines, brushes, mattresses, cigars, bed-springs, combs, gloves, barrels. Following this centre are small places called Petersburg, Baden, New Hamburg and Shakespeare—the latter, very appropriately, bringing the tourist to the city of Stratford. This place, 88 miles from Toronto, is a divisional point on the G.T.R. with six branches entering from various points and an industrial importance based, originally, upon the Grand Trunk locomotive shops which were moved here from Toronto in 1871.

Furniture making has long been Stratford's special industry and its products in this respect have a wide reputation. It is an exceptionally clean and well-kept place with 14 churches and six schools; its parks and public institutions are of a high order and it possesses six banks, hospitals, theatres, skating and curling rinks, driving-park and armoury. The population is about 17,000 and there are 60 industries.

The town of St. Mary's is a prosperous place with seven churches and five schools; it has 25 miles of granolithic walks and industries which include a $750,000 cement establishment, planing, flour and flax mills. Around here and along the railway is a country of mixed farming, fruit growing, and large dairy interests while in this immediate vicinity are sand and stone supplies, cement, clay, limestone and lumber. Succeeding points on the railway are Granton, Lucan, Ailsa Craig, Parkhill, Thedford, Forest, Aberarder, Camlachie, Perch and Blackwell. Sarnia is then reached. It is situated at the mouth of the St. Clair River, on Lake Huron and from it steamers run to points on Lakes Huron and Superior and including Detroit, Cleveland and Sault Ste. Marie.

Sarnia
Aug. 12

Sarnia, where the party takes the Northern Navigation Company's boat for a sail through the Great Lakes, has two miles of waterfront; in its vicinity are supplies of salt and petroleum, it has hydro-electric power and its industries include lumber and saw-mills, stoves, bridge works, brass goods, overalls, cigars, lubricants, wire fencing, automobile castings and parts. There is a large oil refinery and during the war there were three munition plants; the city has 12 churches and five banks and a population estimated at 12,000.

What was for many years the longest submarine tunnel in existence runs between Sarnia and Port Huron, Mich.—a continuous iron-tube 19 feet in diameter, extending under the bed of the river for nearly two miles and built at the great cost (in those days) of $2,700,000. It provides a route for the international traffic of the Grand Trunk.

There are several other train routes through Western Ontario which is one of the richest and most populous districts of Canada. Brantford, population 32,000, is known as the "Telephone City," because it was here that Dr. Graham Bell developed the idea of the telephone, the first successful experiment in talking over a wire for any distance having taken place between the Bell home in Brantford and the neighboring village of Mount Pleasant. On the outskirts of Brantford is St. Paul's Church, "His Majesty's Chapel of the Mohawks," erected by King George III. in 1785, the first church built in Ontario. Woodstock, population 10,051, is regarded by its admirers as the prettiest inland city in Ontario, Ingersoll, population 6,500, is noted for all kinds of dairying produce.

London, population 60,000, has long been known as the "Forest City," on account of the many trees that line its principal streets. It is the commercial metropolis of Western Ontario. It prides itself upon its educational facilities, its schools being among the finest on the continent. The domestic supply of water is obtained from springs, and is probably unique in this respect in a city of such proportions. There are many reminders in name here of the older London. The Canadian London has its Piccadilly, its Pall Mall, its Blackfriars, and so on. Among its many industries it boasts the largest stove works in the British Empire. Chatham, population 18,000, known as the "Maple City" has splendid educational facilities and charming playgrounds. The climatic conditions, with short winters, which are never severe, make the city a pleasant place for a home.

Windsor, with a population of over 33,000, is the largest of what are known as the Border Cities, a group which comprises the municipalities of Ford and Walkerville, Sandwich and Ojibway. These all adjoin and it is impossible for the visitor to say where one ends and the other commences. They have become the motor vehicles manufacturing centre of Canada.

Sault Ste. Marie Aug. 13

It is a pleasant trip from Sarnia across Lake Huron to the great canals and locks of Sault Ste. Marie by the steamships of the Northern Navigation Company. This shipping centre on the banks of the St. Mary River faces the Michigan city of the same name; its canals compete with those on the United States side as they both combine to meet the fall of 22 feet in three-quarters of a mile on St. Mary's River. The Canadian lock is 900 feet long and 60 feet wide and was built in 1888-95 at a cost of $4,300,000. The whole region around this town, from the tossing and turbulent waters of the river, which great engineering feats have thus overcome, to the wilderness which still exists in the background was once the stamping ground of Indians and the headquarters of intrepid Hudson's Bay hunters or French voyageurs.

The "Soo," as it is popularly called, has sprung out of the wilderness in a decade and is now the headquarters of the Algoma Steel Corporation and the Algoma Central and Hudson Bay Railway, the Lake Superior Paper Co. and the Spanish River Pulp and Paper Co., it has steamship connection with all the ports of the Great Lakes and touches the C.P.R. main line; it has seven churches, and 11 schools, and eight banks and owns its electric light and water systems. In the vicinity are iron, copper, gold, silver and lumber with excellent shooting and fishing; the industries include railway, car, foundry and machine shops, tar and chemicals, stump pullers and iron-works. Passing through the locks and canals and river to Lake Superior, that huge inland sea, whose depth is as great in proportion as its volume of water, is crossed and the tourist reaches the lofty points of Thunder Bay and the harbour in which rest at times great fleets of grain and other vessels.

Port Arthur and Fort William Aug. 14

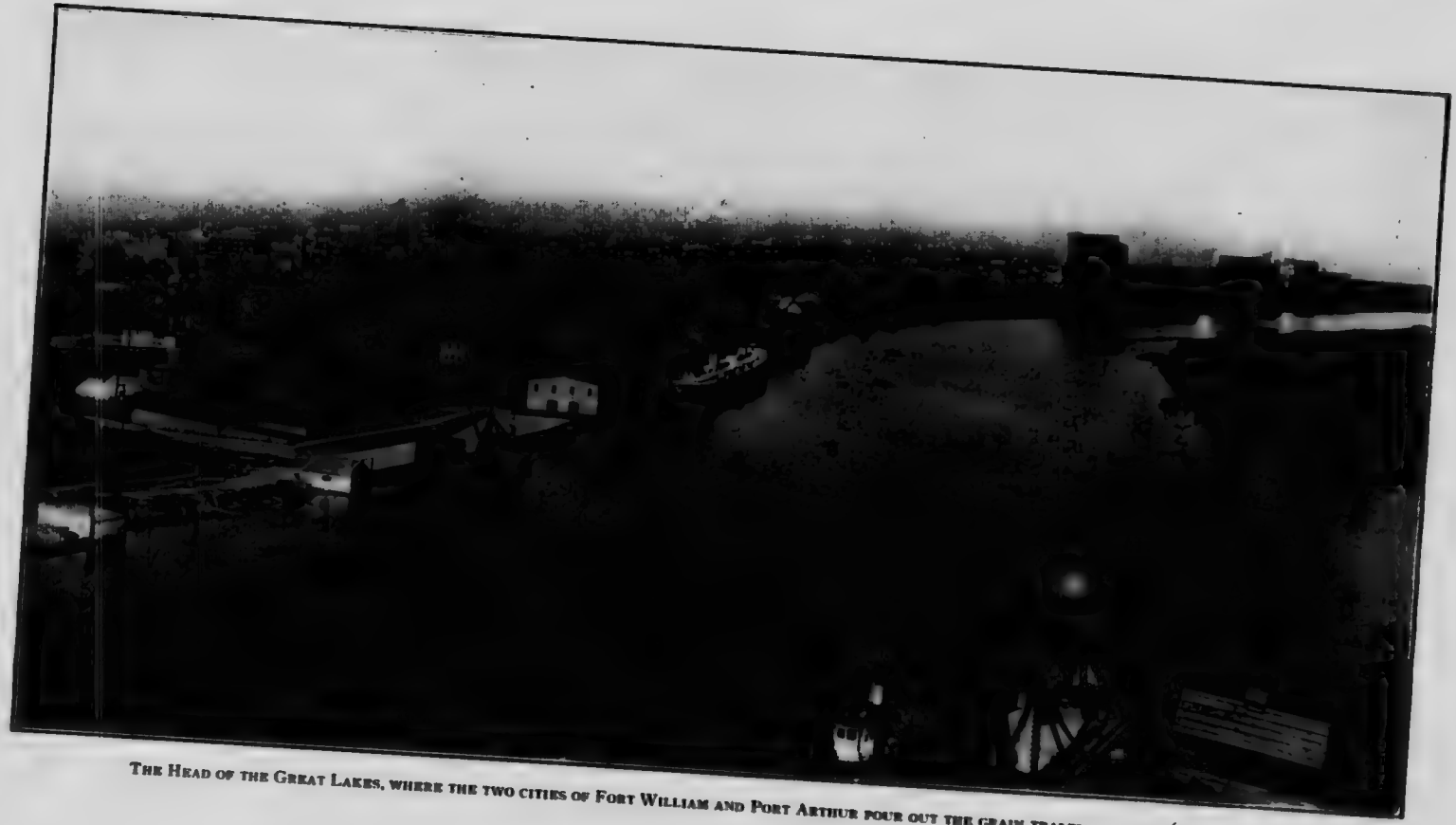
The two towns at the head of navigation on the Great Lakes—2,000 miles from the Atlantic and 1,900 from the Pacific—have long been rivals; they are now so closely connected as to be almost one and between them they possess 32 huge elevators with a combined capacity of 52,000,000 bushels. Both are on the C.P.R. main line, both have direct water communication with the Great Lake ports, both have behind them a vast mineralized country and both have become industrial centres; the population of Port Arthur is 17,000 and that of Fort William 20,000.

Port Arthur believes in public ownership and the municipality controls its own electric railway, light, power, telephone and waterworks; it is the Judicial centre of Thunder Bay District and has the terminals of the Canada Steamship Lines; it has 16 hotels, it has many churches and 10 public schools with a customs house, armoury, sailors' institute, two hospitals, four theatres and eight banks; it boasts one of the largest ship-building plants in Canada and has nine elevators with a capacity of 26,000,000 bushels.

It has, also, a dry-dock 720 feet in length, the Canadian National coal and ore docks, five large lumber companies, three cold storage plants, waggon works and aerated water works and a pulp-mill. It is the centre of a rich farming district which is being opened up by provincial government roads and is considered especially healthy for patients with asthma, etc.; it is on a great scenic motor-car highway running to Duluth and connecting with other automobile routes. All around is a splendid fishing and hunting region. The assessment of Port Arthur in 1906 was $5,000,000 and in 1918 $27,000,000; its trade in 1919 was $6,393,912 of imports and $5,336,810 exports. Its shipyards turn out some of the largest fresh-water passenger vessels and grain carriers in the world; it has a big fishing industry and promises to be one of the greatest industrial centres in Canada.

Fort William, as a settlement, dates back to the 18th century and, in 1801, was a post of the Hudson's Bay Co., to which Indians came down the Kaministiquia in many canoes laden with furs; it is a natural outlet for grain from Manitoba and the West and now has 23 elevators with an enormous storage capacity; it is the site of the Canadian Grain Sample Market and the bulk-breaking point for the freight of Western Canada; it is the Lake terminus of the C.P.R. and Canadian National Railways, while all lines of passenger and freight boats converge here. An inter-city electric railway connects it with Port Arthur and the municipality owns its street railway, telephone, light, water and sewerage systems with a total valuation of $4,000,000.

It has 15 churches and 11 schools, 13 parks, 10 banks and all kinds of public buildings with hydro-electric power estimated at 145,000 h.p. of which 45,000



THE HEAD OF THE GREAT LAKES, WHERE THE TWO CITIES OF FORT WILLIAM AND PORT ARTHUR POUR OUT THE GRAIN TRAFFIC OF THE CANADIAN WEST

h.p. is developed; its larger industries are Ogilvie Flour Mills Co., Canadian Car and Foundry Co., Canada Iron Foundries, National Tube Co., Steel Company of Canada, Great Lakes Dredging Co.; it is the headquarters of the Kaministiquia Power Co. and the Dominion Board of Grain Commissioners, while its 23 elevators store 26,000,000 bushels of grain. Fort William has become the chief coal-handling centre of Canada, its imports in 1919 were $10,559,300 and exports $5,045,872, its bank clearings totalled $41,224,768; here the traveller westward sets back his watch an hour to conform with standard time.

All around this city and Port Arthur are immense possibilities of mineral development with iron, copper, silver, gold and pyrites as the chief; there is abundance of pulpwood with large supplies of pine, tamarack, poplar, birch and jack pine. On one side of Thunder Bay is the long promontory of basaltic rock called the Sleeping Giant which ends in Thunder Cape—near which is the Silver Islet producing while it lasted, fabulous quantities of that metal; Pie Island, near the entrance to the Bay is a mountain of columnar basalt; up the McKellar River in this vicinity is the new million dollar coal dock of the C.P.R. with storage capacity for 2,000,000 tons and machinery operated by electricity which can unload a 10,000-ton freighter in 10 hours. Along the lake shore are beautiful summer resorts and back of these cities is a great country for the sportsman—with fine moose and deer hunting, numerous caribou and black or brown bear; the fisherman can get brook and lake trout, whitefish and herring, pickerel and sturgeon.

New Ontario

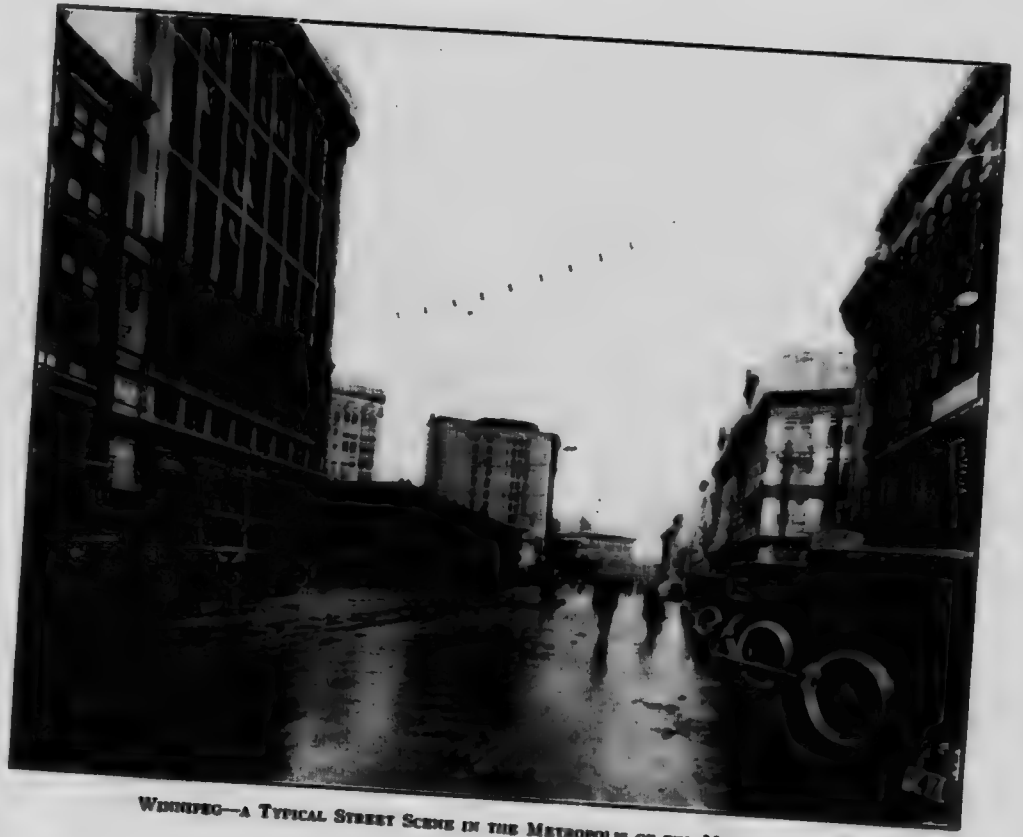
The C.P.R. route from Fort William to Winnipeg is through a wild and broken region, full of lakes and rapid rivers, with valuable forests and a soil rich in varied minerals and a wild animal life tremendously attractive to the hunter. The train mounts to an ever-increasing altitude from Fort William (607) until Kenora (1,032) is reached. Murillo is the railway station for the Rabbit Mountain silver district, and four miles from the station are the Kakabeka Falls, where the Kaministiquia leaps from a height rivalling that of Niagara. The falls can be reached from Fort William by automobile.

The railway follows up this river and then ascends the Mattawan and Wabigoon rivers. There is excellent trout-fishing near to all the stations as far as Finmark. At Eagle two beautiful falls are seen, one above and the other below the railway. The scenery is of the wildest description and deep rock-bound lakes are always in sight. The Sawbill mining country is reached from Bonheur station by Government waggon road. Wabigoon is a point of departure for the Manitou mining region and the Lower Seine and Rainy Lake country can be reached by this route. At Dryden, the Ontario Government has established an experimental farm amidst large areas of good land, especially suited for mixed farming and dairying.

Kenora was at one time called Rat Portage, and is situated on the Lake of the Woods with its area of 1,385 square miles. This is the largest body of water between Lake Superior and the Pacific, and has many beautiful islands and valuable fisheries. Its waters break through a narrow, rocky run at Keewatin and Kenora and fall into the Winnipeg River. The district around the lake is one of the finest summer resorts in America and the forests along its shores make Kenora the centre of a large lumber trade and shipment to the prairies; it is also a mining centre, with gold-fields under development in the vicinity, and in the Rainy Lake and Seine River districts to the north, which are reached by steamer through a most picturesque region.

Keewatin, nearby, is a small place but with great possibilities. Here the Lake of the Woods breaks through a narrow rocky gorge and falls into the Winnipeg River. Nearby are the immense works of the Keewatin Power Co., which are developing one of the greatest water-powers in the world. This project is making the Lake of the Woods a gigantic mill-pond and affording most convenient sites for pulp-mills, saw-mills, flouring mills and other establishments which may supply the needs of Western Canada and manufacture its products on their way to eastern markets. At Keewatin, also, a mammoth flour mill, built of granite quarried on the spot, is owned and operated by the Lake of the Woods Milling Co.

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WINNIPEG—A TYPICAL STREET SCENE IN THE METROPOLIS OF THE MIDDLE WEST

THE PROVINCE OF MANITOBA

Manitoba: The Centre of Western History

Manitoba is the first portion of the great Western Plain to be seen by the tourist after leaving the lake region. As a whole this vast body of land is divided politically into the Provinces of Manitoba, Saskatchewan, Alberta and the North West Territories—each of the provinces reaching from the United States boundary line to the 60th parallel of latitude; the region from this parallel to the farthest north being included in the Territories. The Western Plain is drained by three great river systems with lake reservoirs—the Nelson and Churchill running into Hudson Bay and the Mackenzie draining into the Arctic Ocean. The Nelson system of lakes is largely located in Manitoba—Winnipeg, Winnipegosis and Lake Manitoba—with the Saskatchewan, Red and Assiniboine rivers as connecting links.

The great hard wheat belt stretches across the three provinces and gives the largest continuous expanse of rich soil on the continent—a rich top-soil being succeeded by a deep sub-soil containing stores of nitrogen, potash and phospheric acid; the total area is 485 million acres and almost all of it is suitable for wheat-growing. If the total present acreage in field crops were multiplied a dozen times it would exceed in product the world's total yield of wheat, equal it in oats and give half its product in barley, and yet only half of the cultivable area would be touched!

Manitoba has an area of 251,832 square miles. Winnipeg, its capital, is in latitude N. 49° 53′ and further south than any city in the British Isles; as a province it is larger than Germany, Belgium, Holland and Switzerland combined; its climate is bright and the atmosphere dry, clear and pure. Southern Manitoba is wonderfully fertile and the soil unique in its richness; north-eastern Manitoba, extending from Lake Winnipeg to Hudson Bay, is peopled chiefly by hunters and trappers, but there are undoubtedly large areas of good agricultural land with luxurious grasses, which especially fit it for mixed farming; the region running up to Hudson Bay promises great mineral development and gold prospecting had, in 1918, turned into production, while large bodies of copper ore were reported—the Tonopah property estimating 250,000,000 tons in sight; various new gold-bearing veins, extensive lignite coal formations and important oil shales resources are being announced from time to time.

Northern Manitoba, also, in the past few years has shown immense riches in fur-bearing animals, great forests of timber and pulpwood, valuable resources in water-power. Everywhere in this region of wild waters, as well as land, there are vast quantities of sturgeon, lake trout, white fish and pickerel, while Hudson Bay affords in its whale fisheries the chance of capturing $10,000 or $20,000 in value as the result of one haul. The fertile lands of Manitoba, in 1918, produced $180,000,000 of field crops for a population of 553,860, with only 5,000,000 acres cultivated out of a known fertile area of 25,000,000; its trade included, in 1919, $298,270,478 of exports and $470,650,679 of imports; its bank clearings were $2,353,647,032 and the estimated assessable value of property is $680,000,000; its extensive water-powers were reported, in 1919, as including 2,500,000 h.p. in the Nelson River alone.

It is hard to estimate Manitoba's wealth—even from the facts stated above and the known riches of its southern wheat-lands. Its live-stock is growing greatly in numbers though the farmers have only of late years taken to mixed farming; horses increased in number from 293,776 in 1912 to 324,175 in 1917, cattle from 415,601 to 560,047, and sheep from 40,800 to 80,588. Poultry and bee-keeping are easy and profitable pursuits; co-operative marketing has been largely developed by and for the farmers, agricultural societies have a large membership and the grain-growers' organization is a notable one from both practical and political points-of-view.

Historically, Manitoba has had rather turbulent annals and has been the centre of Western political life. In its early existence it was a territory of the great Hudson's Bay Co., which once ruled with despotic authority from the Great Lakes to the Pacific under a Royal Charter issued by Charles II in 1670; its lakes and rivers and silent wildernesses were a vast preserve for the English hunter and trapper and the French voyageur; later, it was the scene of fierce rivalry between the Hudson's Bay and other companies. In 1870, two centuries after Prince Rupert first sent his gallant men to hunt and shoot, the settlers of Red River, living within the protective circle of Fort Garry and the sound of company guns,

were taken into the new Dominion of Canada; there followed the troubles under Louis Riel and flash-in-the-pan rebellion with the gradual settling down of the new province into a political partner of the Canadian people; the completion of the C.P.R. in 1886 made the population a part of the commercial life and progress of Canada and production, industry, immigration, did the rest. After 250 years of fur-taking and trading, this one-time annex of the Hudson's Bay Co. still sells $1,000,000 worth a year. To sportsmen, the province provides flocks of prairie chicken, the teal, the mallard and other varieties of duck and, in certain parts, the deer, black and cinnamon bear, the elk, moose and caribou.

Winnipeg
Aug. 15-17

Situated at the confluence of the Red and Assiniboine Rivers, near the site which Lord Selkirk's attempts at colonization have made famous, Winnipeg was known to early history as Fort Garry from the Hudson's Bay fortified post, of which a few ruins yet remain. Founded in 1860 and incorporated in 1874, its name is derived from the Indian Ouinipigon, or "muddy water"; its population of 200 in 1870, when Louis Riel and his half-breeds held sway for a brief period before the Wolseley expedition put an end to their wild dreams, became 42,340 in 1901 and 136,035 in 1911, and is today estimated at 183,000 people—with St. Boniface and other suburbs 273,000; a transportation system which centres here all eastern and western lines passing across the great plains has made it the world's largest primary grain market; it is, besides, the chief wholesale distributing centre of the Prairie Provinces and, thanks to cheap electric power, is rapidly becoming one of the great industrial centres of Canada.

In the 10 years ending with 1914 the value of buildings constructed in Winnipeg was $128,264,505 or an average per year of $12,826,000; in 1900, the Winnipeg Electric Street Railway carried 3,002,538 passengers and in 1914, 58,489,987.

The city is estimated to have an available water-power in the Winnipeg River, alone, of 509,000 h.p.; on other rivers flowing into Lake Winnipeg within transmissible distance there is 72,000 more horse-power; still other rivers connecting with the various large lakes in a certain radius of the city is another 72,000 h.p. It has done much in this connection and the Greater Winnipeg Water Aqueduct is one of the world's larger undertakings. The length of the conduit is 96 miles, the water is carried by the use of gravity and the difference in elevation from Shoal Lake to Winnipeg is 294 feet, while the cost of the system to the end of 1918, was $14,822,444.

Shoal Lake is an offshoot of the Lake of the Woods with a drainage area of 360 square miles and is 96 distant and 294 feet above the city level; its capacity is 85,000,000 gallons of water every 24 hours. The city develops its own power with 60,000 h.p. in use and 50,000 h.p. under construction; its C.P.R. interests include immense workshops and the two largest train-yards in the world—one having 110 miles of track and the other 70 tracks of 183 miles, the Royal Alexandra Hotel, a famous C.P.R. hostelry erected and enlarged at a cost of $2,000,000, an elevator with 1,000,000 bushels capacity and an unusually handsome railway station; the Canadian National Railways and the Grand Trunk Pacific have large workshops and interests, including the Fort Garry Hotel, one of the finest hotel structures in the West, and a splendid new railway terminal.

Winnipeg has over 300 factories with a yearly pay-roll of $13,000,000 a, product of $54,000,000 and 23,000 employees; its industries include clothing, hats, tents, boxes, carriages, cigars, electrical fixtures, cement, confectionery, hemp fibre, implements, flour rolling and planing mills, cordage, jute goods, breakfast foods, structural steel, steel boilers, farm traction engines, soaps, jewellery, harness; its turnover as a wholesale distributing centre is placed at $250,000,000 a year, its bank clearings in 1919 were $2,316,724,263 and its import trade (March 31, 1919) $42,799,302. Hotels other than those mentioned include the Empire, Winnipeg, Leland, St. Regis, Seymour and Strathcona; the city has 60 miles of electric railway within its limits and 44 miles of suburban lines; it has parks, hospitals, great flouring mills, a number of grain elevators, huge abattoirs and, being the Provincial Capital, is the seat of Government House and the Parliament Buildings; its larger offices include the land offices of the C.P.R. and western immigration offices of the Dominion Government; it is the seat of the University of Manitoba with its affiliated institutions of Wesley College, Manitoba College, St. Boniface College, St. John's College, the Manitoba Law School, Medical College and Manitoba Agricultural College with a total of about 200 teachers and 2,000 students.

St. Boniface, on the Red River, is really a suburb of Winnipeg; technically it is a city of 11,000 people—largely French—the seat of a Roman Catholic Archbishop, with a cathedral, churches, a convent, orphanage, boys' academy, Catholic seminary and college; it has its own electric light and cheap power, numerous railway connections and a good water system, five banks, five lumber yards and planing mills, four elevators and a linseed mill, two flour mills, three sash and door factories, paint and tar-paper works, ceiling and roofing plant, marble and glass works; it has two abattoirs and Union Stock markets.

Portage La Prairie and Carberry August 17

From Winnipeg to Brandon the trains traverse by C.P.R. a region of typical prairie richness and agricultural interest. Portage La Prairie (altitude 854 feet, population 7,000) is a progressive town on the main lines of four transcontinental railways—Canadian Pacific, Canadian National, Grand Trunk Pacific and Great Northern; it is 15 miles south of Lake Manitoba and has notable fisheries and summer resorts; it is the county town with various public institutions and six banks; it owns large and richly wooded parks and its public utilities. Industries include seven elevators, two flour mills, two lumber yards, threshing machines and farm implements, structural castings, corrugated iron culverts, steel grain bins, oatmeal mills, pumps, sashes and doors, pickles, biscuits. A C.P.R. branch runs from here to Saskatoon and Edmonton.

After Portage La Prairie, stations are numerous—at intervals of five to eight miles and including Burnside, Bagot, MacGregor, Austin, Sidney, Melbourne—until Carberry is reached. They rise in altitude from 869 to 1,247 feet, many of them are bright and busy towns, at nearly all of them are tall elevators with here and there a flour mill; there are many ponds and small streams and stock farms.

Carberry, with a population of about 1,000, has three churches and three banks and is the centre of a good farming district. The passengers detrain at Carberry and proceed to Brandon by motor.

Brandon Aug. 17

Brandon is a divisional point on the C.P.R., 133 miles west of Winnipeg and through it also passes the Canadian National Railway and the Great Northern; it has a population of 18,000 and is the seat of Brandon College, a Baptist institution with 17 teachers and (1916) 235 students; it has a ladies' college, a business college, a normal school, collegiate institute and nine public schools; it has a convent and the seat of Ruthenian training school, Indian industrial school, Dominion experimental farm, a provincial general hospital, land titles office and provincial asylum; it has 10 banks and the municipality owns the electric street railway, electric light and power plant, steam-heating and gas plants. Most of the leading farm implement manufacturers of the continent have distributing houses here, and there are 20 wholesale houses in the city; industries are growing greatly and include flour, gasoline engines, cement blocks, fireworks, oatmeal, corduroy coats, furs, hats, leather, harness, saddlery, tents, mattresses, lightning rods, grain grinders, windmills, pumps, fire engines, sewing machines, furnaces, show cases, school desks, church pews and pulpits, lenses, cigars and confectionery. Brandon is, also, the centre of a rich agricultural district with two or three hundred tributary towns and villages.

Beyond Brandon the railway draws away from the Assiniboine River and rises from its valley to a rolling or undulating prairie well occupied by prosperous farmers, as the thriving villages at frequent intervals prove. Kemnay, Alexander, Griswold, Oak Lake, Routledge are passed. Virden and Elkhorn are market towns of attractive districts and, at the latter place, is an Indian industrial school erected by the Dominion Government.

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THE WEALTH OF THE PRAIRIES—A WESTERN WHEAT FIELD AS THE REAPERS BEGIN THEIR GOLDEN HARVEST

THE PROVINCE OF SASKATCHEWAN

Saskatchewan: The Great Grain Centre of Canada

This Province is the chief wheat producing division of Canada with a land area of 156,000,000 acres of which 94,000,000 are considered as fitted for agriculture with, as yet, only 15,000,000 acres under crop. Its population of 650,000 seems absurdly small to handle so vast and fertile a region, yet its farmers produced in 1917, 56 per cent of all Canadian wheat as against four per cent. in 1904 and, in its banner year of 1915, contributed 375,000,000 bushels of wheat, oats and barley to Canada's total. Its elevator capacity is 68 million bushels and these tall receptacles of grain are to be seen at every central point in the Province. Live-stock and mixed farming are steadily increasing with a total of 551,645 horses in 1912 growing to 880,301 in 1917, 646,140 cattle to 1,211,090, 114,810 sheep to 127,892 and 344,298 swine to 573,938.

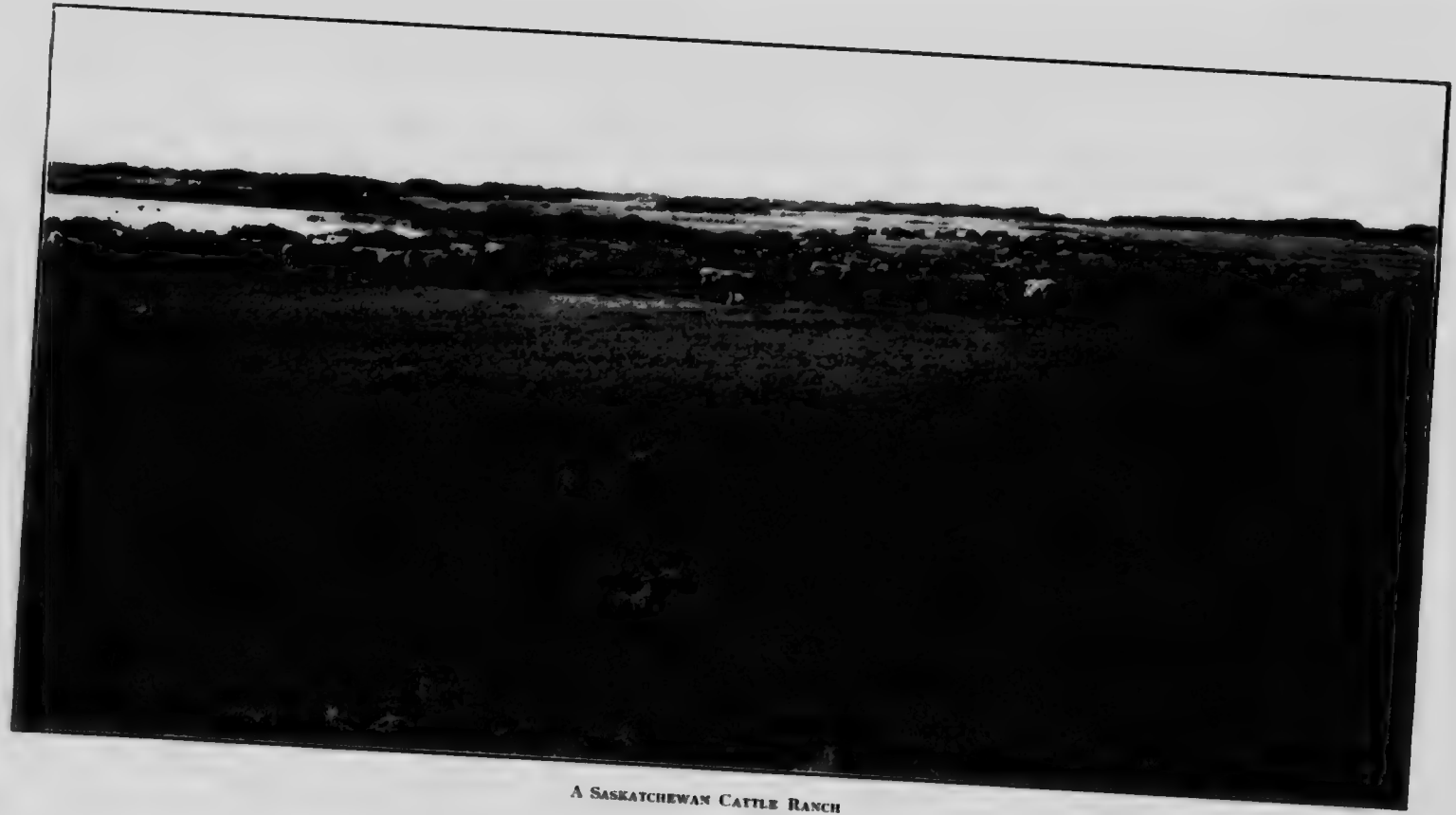
The southern part of the Province is prairie land with the usual characteristics of level fertility and prosperous farming, the central and northern regions are wooded with many lakes and rivers and forests—the latter said to contain from eight to fourteen billion feet of lumber; the rivers have water-powers with the potential development of 1,000,000 h.p. and the lakes are stocked with valuable whitefish, trout, pickerel and sturgeon as to which commercial fishing is carried on both in winter and summer. To the sportsman these waters afford ample occupation while, in the Province as a whole, $1,000,000 worth of furs is still trapped annually with big game plentiful in the north and great herds of caribou. As to minerals there are extensive deposits of lignite coal under the soil of the south together with pottery and fire clay, while discoveries north of the Saskatchewan River have been made in gold, copper, iron and glass sands. Indications of oil and gas are numerous, but very little mineral development of any kind has yet been made.

Historically, the province was created out of the old Northwest Territories in 1905 and its annals have been unmarked by scenes of violence or civil strife. It is crossed by three transcontinental railways, has a number of branch lines, good rural roads and a provincial government telephone system. In agricultural organization it has led the Dominion and its Saskatchewan Elevator Co. owns and operates 296 elevators and handled in six years to 1917, 121 million bushels of grain; co-operative creameries have been most successful and now number 24, with 7 cold storage plants, poultry killing stations and egg candling plants, all operated by the Saskatchewan Co-operative Creameries. The Provincial export trade (March 31, 1919) was $20,707,513 and imports $17,388,037; its bank clearings in 1919 were $424,504,941; the value of its field crops in 1918 was $300,000,000.

Regina Aug. 18

From Manitoba the C.P.R. track enters Saskatchewan about a mile east of Fleming. Moosomin, the first town reached in that Province, lies upon the level prairie and is the centre of an important agricultural region in which mixed farming is becoming a great factor. With about 1,400 people it has five churches, two banks and two flour mills, it is the seat of a judicial district and possesses many public buildings and schools. The villages of Red Jacket, Wapella—with six elevators—and Burrows follow; Whitewood with about 500 population has many modern conveniences, four churches and a $15,000 school, three elevators, a skating and curling rink, with good fishing a few miles away; then come Perceval and Broadview, the latter a railway divisional point situated at the head of Lake Ecapo with a Cree Indian reservation not far away and a population of about 800 which boasts five churches and two elevators. Here the traveller changes standard to "Mountain" time—an hour slower.

Westward from this place the line of prairie gradually rises and Oakshela, Grenfell, with 800 population, six churches and six elevators, Summerberry and Wolseley are passed in rapid succession. The latter place caters, like other villages, to a surrounding agriculture population and its 1,100 people have six churches, a convent, collegiate, public school, etc., with seven elevators and two banks. Sintaluta, a village of 500 people, three churches and two banks follows and Indian



A Saskatchewan Cattle Ranch

Head is reached. This little town has a Dominion experimental farm in the vicinity which presents many features of public interest; it has four churches, two banks and 10 elevators.

Qu'Appelle, with an altitude of 2,123 feet, is the next point and is a supplying and shipping centre for a large district, with a good road extending 20 miles to Fort Qu'Appelle—an outpost of the Hudson's Bay Co. beautifully situated in the deep valley of a river of the same name. The Fort has a place in the military history of the west and, in its vicinity, are several Indian reservations. The town itself has four churches, four elevators, two banks and various public buildings; around it and for some miles along the railway are trees and a well wooded country, with a soil of rich clay loam well fitted for mixed farming. At McLean the famous Regina plain is reached and this extends eastward to where the Dirt Hills are seen as a faint line upon the south-western horizon; in its nature it is a broad, level, treeless expanse of the finest agricultural land with a rich soil reaching to a depth of 20 feet or more. Balgonie and Pilot Butte are passed and Regina reached.

The capital of this Province and the distributing point for a large and rich country to the north and south is an important and growing city of about 45,000. It is a divisional point on the C.P.R., the C.N.R. and the G.T.P. and a dozen lines radiating out from the city in all directions; it has 15 banks, two hospitals, 15 schools with collegiate and normal schools; Regina College is an important Methodist institution and there are a large number of hotels including the Wascana, King's, Kitchener and Empire. The Parliament buildings constitute an imposing picture on the borders of Wascana Lake, occupy 160 acres and cost $1,500,000 and the city is, of course, the home of the Lieut.-Governor and centre of the political and social life of the Province.

It was also for many years the headquarters of the famous Royal North West Mounted Police—now re-named the Royal Canadian Mounted Police which also now includes the Dominion Police and the headquarters are at Ottawa; it has two departmental mail order houses, each with $500,000 of trade, and is the seat of the provincial annual exhibition; it has a $2,000,000 oil refinery and is a distributing point for farm implements and machinery; the city owns its stock yards, electrical light and street railway system, its water supply and sewerage system and there is a co-operative creamery. Industries are developing rapidly and include mattresses, cigars, petrified stone, aerated waters, wire and steel works, cement blocks, pressed brick, soap, sashes and doors, flour mills, elevators and machine shops. Northward from Regina is Lost Mountain Lake, a famous summer resort. Passing from the capital Grand Coulee, Pense, Belle Plaine and Pasqua are rapidly left behind and at the latter point a traveller can connect through Estevan for St. Paul and Minneapolis.

Moose Jaw
Aug. 18

Moose Jaw is the next important place—the name being an Indian abbreviation of "The-Creek-where-the white-man-mended-the-cart-with-a-Moose-jaw-bone." Here, 398 miles west of Winnipeg, a big city is in the making with a present population estimated at 25,000. It is the centre of a fine agricultural country, is a divisional point of the C.P.R. with 52 miles of trackage in its yards and is also on the C.N.R. and G.T.P. It has the chief stockyards between Winnipeg and the coast, a Dominion Government elevator with 3½ millions bushel capacity and is a notable milling point and wholesale centre; it has nine public schools, many churches, various educational institutions and public buildings, a $140,000 theatre, with 3,000 h.p. available for manufactures; it owns the light and water systems—the latter having an incinerating plant—it has 12 banks and over 200 wholesale houses; its industries include flour mills, sashes and doors, faced and pressed bricks, tiles and pottery, bridge and iron-works, confectionery and a creamery, lumber companies and an abattoir.

From here the railway runs through many villages and a somewhat varied country—Boharm, Caron, Mortlach, Parkbeg, Secretan, Chaplin, Ernfold, Morse, Herbert, Rush Lake, Waldeck and Aikens. At Chaplin one of several large bodies of water called the Chaplin Lakes is reached—notable for having no known outlet and as being alkaline in character. The country is treeless from the eastern border of the Regina plain to the Cypress Hills, 200 miles, but the soil is excellent nearly everywhere. The prairies about and beyond Chaplin are marked in all directions by buffalo trails and scarred and pitted by their "wallows." Antelope may be sometimes seen, and coyotes and prairie dogs. Near Morse is a salt lake, and not far beyond is Rush Lake, a large area of fresh water and a

A Saskatchewan Cattle Ranch

favorite resort of waterfowl—swans, geese, ducks and pelicans—which at times congregate here in myriads. At Rush Lake there are some splendid farms, and on the south side there is one of 700 acres under irrigation.

Swift Current follows and is situated on a pretty stream of the same name. It was incorporated as a city in 1914 and has a population of about 5,000; it is the centre of a rich farming region which is being rapidly filled up with American and eastern Canadian farmers; it has Government Meteorological station, judicial district offices, customs house and Dominion land office; it has five churches and five banks, five elevators and seven lumber yards with a flour mill, cement factory, aerated water factory, planing mill and creamery. From this town on to Medicine Hat in South-[illegible] Alberta, the route skirts the northern base of the Cypress Hills as they gradua[illegible]y r[illegible] in the west to an altitude of 4,700 feet; Beverley, Seward, Webb, Antelo[illegible] are some of the villages passed; Gull Lake has a population of about 1,100 with five lumber yards and eight elevators, several industries, a couple of parks and four churches, splendid farm lands around it and two good hotels; Carmichael, Tompkins, Sidewood and Crane Lake follows.

Near the latter village there is a large stock-farm with 1,200 acres irrigated and stocked, usually, with 7,000 cattle and 500 horses. Between the railway and the Cypress Hills, along this part of the route is a magnificent stock country with rich grasses possessing special attraction for animals; valleys and groves of trees giving ample shelter at all times of the year and numerous streams affording an unfailing supply of water; profits to the stockmen correspond with the favourable conditions. The village or towns of Cross, Maple Creek, Kincorth, Halton and Cummings follow and end the journey in Saskatchewan so far as this, the [illegible]-ect line of the C.P.R., is concerned. Maple Creek is 64 miles east of Medicine Hat, Alberta, and has a population of about 2,000, four churches, two banks and four elevators; it has, also, several implement warehouses, lumber yards and a race track, an armory and a public park.

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THE PROVINCE OF ALBERTA

Alberta: The Western Home of Coal and Mixed Farming

This province has long been the great ranching centre of the west, as well as the source of a potential supply of coal so great as to be almost inconceivable. Towns and cities are built over it, cellars in the Edmonton district have been dug out of coal and into it, the mines and the farms combine to make Alberta a treasure-house of riches. It has been estimated that 1,072,000,000,000 tons of coal underl... 25,000 square miles of surface, an average of 43 million tons to the square mile or 90 per cent. of Canada's total supply and equal to 28 per cent. of the coal resources of the United States.

The actual production in 1917 was less than 5,000,000 tons, of which 637,829 tons were lignite and 2,206,868 tons anthracite and the balance bituminous; values increased from $8,283,000 in 1915 to $14,197,000 in 1917, and to $23,912,000 in 1918. The external market was in Manitoba, Saskatchewan and British Columbia, and 10,000 men were engaged in mining. Up in the north, 800 miles from Edmonton, all kinds of mineral and agricultural development are possible. The Peace River country has been called "The Last Great West," and along the Athabasca River enormous quantities of bituminous sands exist with estimated petroleum resources of 200,000 million tons and exposed supplies of gypsum estimated a... 217,000,000 tons. In various parts of the province natural gas flows freely from wells, and the oil-fields near Calgary, as well as those of the north, have large possibilities.

As to agriculture, there are few limits to production in a province with an approximate land area of 162 million acres, of which 80,000,000 acres are estimated as suitable for farming with only 7,000,000 acres under cultivation and this small area producing in 1918 $261,564,000 worth of agricultural products. Wheat is grown to latitude 59 north. In live-stock the horses of the province, in 1918, were valued at $84,662,000, the cattle at $125,000,000, sheep at $4,983,000 and swine at $14,437,000—a total of $230,000,000. The forest resources of Alberta are considerable—especially in white spruce and pulp-wood; the water-powers are extensive but slightly developed and the lakes are well-stocked with fish; game is fairly plentiful and includes the last known herd of wild buffalo. Irrigation has been found necessary in the south and the C.P.R. developments in this respect are widely known; in northern parts there is abundant precipication.

The winter climate is greatly modified by the warm "Chinook" winds and the snowfall is light; cattle and horses pasture in the open throughout the cold season. In manufactured products the census of 1917 puts the annual value at $71,669,423; the bank clearings of 1919 were $65,034,151 and the export and import trade $18,181,565. Historically, Alberta has had peace within its borders, problems of development as its chief administrative issues, production as its great ambition; it was born as a province in 1905—like Saskatchewan—out of the old Territorial boundaries and it is now on the way to greatness with 500,000 population, increasing from year to year. When it became a province in 1905 its wheat crop was two million bushels, 10 years later it was 60 millions; in 1905 its oat crop was 9½ million bushels and 10 years later 90 millions. In 1916 its dairy products, furs, wool-clip and poultry totalled $18,000,000 in value.

Entering Alberta at the village of Walsh with an altitude of 2,437 feet, the villages of Irvine, Pashley and Dunmore are passed with many mixed farms and great cattle ranches in sight; rocks of the cretaceous age occur in which remains of gigantic saurians and other extinct animals of pre-historic periods are abundant. From Dunmore the main line of the C.P.R. drops into the valley of the South Saskatchewan which, at Medicine Hat, in an altitude of 2,168 feet, is crossed by a fine steel bridge. This city of 11,000 people is famous for its enormous flow of natural gas, which is sold to manufacturers at 5 cents per 1,000 cubic feet and for domestic purposes at 20 cents; it is also known for the splendid mixed farming district around it, and for apples, plums and small fruits which grow as freely as in a more southerly region. It is the seat of a demonstration farm operated by the Dominion and an important station of the Royal Canadian Mounted Police.

It has eleven churches, nine schools, four parks and six banks with a general hospital and the municipal ownership of its natural gas franchise—estimated as equivalent to 200,000 h.p., of which only one-tenth is in use—electric light, power, water and filtration plants. Its industrial establishments include an Ogilvie flour mill and elevator, Lake of the Woods and Hedley Shaw mills and elevators, the the Alberta Clay Products Co., three planing mills and two stoneware plants;



GROWING MIRACULOUS CROPS ON IRRIGATED LAND IN ALBERTA

other industries are: bricks, foundries, farm tractors, iron-rolling and linseed-oil mills, pump and brass and galvanizing plants, lumber yards, etc.; its assessment is $26,000,000 and bank clearings $23,778,000. Beyond Medicine Hat and the river the prairie plateau rises steadily up to the base of the mountains. At Redcliff, a growing centre of a fine stock-raising country—with some of the largest herds of Galloway cattle in the world—industries are becoming numerous and include pressed bricks, ornamental clay products, glass-rolling mill, bolts, farm implements.

Succeeding villages are Bowell, Suffield, Alderson, Kininvie, Tiley, Bantry, Brooks, where the Duke of Sutherland has large interests, Cassels, Southesk, Lathom and Bassano. During this part of the journey the Bow River occasionally appears to the south. The prairie here is seen to advantage, and before August it is a billowy ocean of grass. Cattle ranches are numerous and farms appear at intervals. The entire country is underlaid with two or more beds of good coal and natural gas is frequently found in boring deep wells.. From Tilley, on a very clear day, the higher peaks of the Rocky Mountains may be seen, 120 miles away. Just west of Alderson the line enters the 3,000,000-acre irrigation block of the Canadian Pacific.

The block extends to within a few miles of Calgary, a distance of 145 miles. It is the largest irrigation project on the continent and is divided into three sections. Work has been completed on the western section and a great part of the land marketed. The eastern section, extending from Alderson to Bassano, is now also ready for settlement. About three miles south of Bassano is located the great Horse-Shoe Bend dam, which has made the waters of the Bow River available for irrigation. By means of the dam the ordinary water level at the site is raised 45 feet so that the waters flowing from the far-distant eastern slope of the Rocky Mountains are diverted through a total length of 2,500 miles of canals and distributing ditches over about 1,800 square miles of fertile prairie country. The C.P.R. has invested over $17,000,000 in this enterprise.

Crowfoot and Cluny and Gleichen are next reached. Near Crowfoot, and south of the railway, is a large reservation occupied by the Blackfoot Indians, and some of them are seen about the stations. At Namaka are located some of the most productive farms in Western Canada and very rich harvests are reaped annually.

Gleichen
Aug. 19

Gleichen is a progressive place of 1,000 population, with an altitude of 2,900 feet; it has three churches and six elevators, two banks, a cold storage plant and two lumber yards; it has dry-farming to the north, wheat to the south and ranches all around and municipal ownership of utilities. Near it are interesting irrigation experimental farms and following it is a succession of villages—Strathmore, Cheadle, Langdon, Shepard, Strangmuir, Carseland, Dalemead and Indus.

The elevation steadily rises until at the last place mentioned it is 3,340 feet; after passing Gleichen, also, the Rockies are clearly visible with magnificent lines of snowy peaks and veiled or brilliant outlines extending into distant horizons. Near Strathmore are located a great number of the Canadian Pacific's "ready-made" farms. Under this policy the company improves farms in advance of their sale, so that the arriving settler finds awaiting him a farm with comfortable house, fine barn, a drilled well and about 50 acres in crop. The whole farm is fenced. The price of these improvements is added to the price of the land, the whole sum being payable in a space of 20 years.

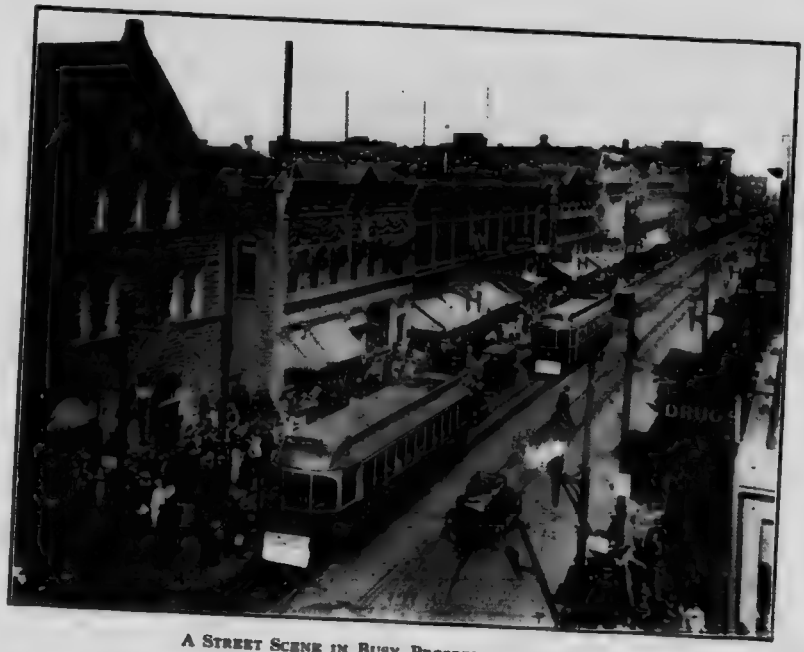
Calgary
Aug. 19

Calgary, founded in 1883 and incorporated in 1884, with its 80,000 population, is the largest city in Alberta and the centre of every activity and progressive development in the southern part of the province. It has the general offices of the C.P.R. and the head offices of its department of natural resources, under whose jurisdiction comes the great Bassano irrigation project; the big Ogden car-shops of this railway, costing three and a half million dollars, are a feature of the city's development; it has C.P.R. branches to Edmonton, Macleod, Lethbridge, Bassano and Crow's Nest Pass in British Columbia; G.T.P. lines to Tofield and Edmonton; a C.N.R. branch to Saskatoon; it has 50 churches, 37 schools of all kinds, a convent and four colleges with 27 banks.

The city owns and operates its electric street railway—82 miles in length—a 14-mile gravity water system, its light and power plant, a sewerage system and



THH FORT GARRY HOTEL AND UNION STATION FROM BROADWAY, WINNIPEG



A STREET SCENE IN BUSY, PROSPEROUS CALGARY

asphalt plant; it is the trading centre of a very large agricultural and stock-raising district and is said to have 200 wholesale firms and to be the headquarters of 1,000 commercial travellers; it is the chief supply station for mining districts in the Rockies, a milling centre and the home of notable cattle auction sales; its imports totalled $8,199,514 in 1919 and its bank clearings were $355,009,588. There are said to be 80 industrial plants in the city, backed up by extensive coal beds in the near vicinity, with lime, brick-clay and building stone, zinc, copper and iron deposits—aided, also, by abundant water of which 31,000 h.p. is in use with 48,000 more available when required, and by natural gas piped from Bow Island 100 miles away, and supplied at 35 cents per 1,000 cubic feet for lighting and 15 cents for power purposes. The industries include saddlery, show cases, tents, waggons, aerated waters, soap, rolled oats, meat products, leather and linen goods, iron and metal works, flour, harness, cigars, confectionery and cement blocks, boxes, breakfast foods, brick, beds and building material.

Near High River, Alberta, on the C.P.R. Calgary-Lethbridge Line and 40 miles south of Calgary is the famous "Bar U" ranch of George Lane, the chief of western ranchmen and known as the largest breeder of Percheron horses in the world. Adjoining it is the Beddingfeld ranch of 1,600 acres which H.R.H. the Prince of Wales purchased during his Canadian Tour of 1919. It is on the middle fork of the Highwood River and was homesteaded by the Beddingfelds in 1883; it has a comfortable home and up-to-date farm buildings and is in full view of the snow-capped ranges of the Rockies; it has fine, well-watered pasture lands and wooded *coulees* which afford shelter for stock. A considerable portion of the ranch is under cultivation and with it the Prince acquired 400 head of pure-bred Clydesdale horses and 150 of range cattle, but these were sold in order to make way for special shipments from England which included a number of thoroughbred horses, short-horn cattle and Shropshire sheep to form the nucleus of breeding herds. These animals were to be selected in part from the King's own breeding establishments.

The trip from Calgary to Banff is made by motor stopping at Ghost River for lunch on the way.

The Rocky Mountains

It is difficult to find language to describe the glorious scenery of the Rocky Mountains as the vast piled-up masses of rock and earth come into view, or are passed in the rapidly moving train, or studied from some chalet in the clouds or some luxurious hotel in a scene of unrivalled beauty. They are streaked by strange colours of nature's wierdest creation; marked by huge glaciers of ice and stamped by great forests of green or fireblackened or sun-browned trees; seamed by gigantic rivers looking like rivulets in the distance and dashing down great inclines, or between vertical walls of rock, or through beautiful valleys lying in the lap of mountain ranges; rising to cloud-crowned heights where the sun at times casts a golden halo over scenes of sombre splendour.

Sir Edwin Arnold once told the writer in passing through the Selkirks that he had traversed the Himalayas and the Andes, the Urals and the Alps—all the great ranges of the world—but he had yet to see anything that would equal the majestic grandeur of the scenery of the Canadian Rockies. The C.P.R. on its way to Banff, passes from Calgary to Keith and Cochrane, Morley and Kananaskis, Exshaw and what is called The Gap to Canmore and Bankhead—through altitudes rising from 3,521 feet at Keith to 4,596 feet at Bankhead. From Calgary to The Gap the scene is preliminary, the scenery a preparation of the eye and mind for what is to come and, beautiful as it is at this stage to the traveller on a rapidly-moving train, much more so is the gradually opening panorama to the motorist who can stop his car and gaze at many of the everchanging sights which only flash past him in a railway train. The great automobile road which it is intended to build from Calgary right through the mountains to Vancouver is completed as far as Banff—the Governments of Canada and British Columbia and the C.P.R. joining in construction. At Castle Mountain the motor road branches off through the beautiful Vermillion Pass and when completed will connect with one already in existence running from Golden to Cranbrook on the Crow's Nest branch of the C.P.R.

For the description of the mountains which follows credit must, in the main, be given to the C.P.R. in one of its annotated guides; the salient points are sketched, enough is said to feed the imagination in passing through or to review the memories in an after time. Leaving Calgary (alt. 3,439 ft.) by motor on the trip of 87 miles to Banff, the Bow River is closely followed and by the time Coch-



BANFF, CAPITAL OF CANADIAN NATIONAL PARK, A RESERVATION OF 5,732 SQUARE MILES. THE TOWN HAS AN ALL-YEAR POPULATION OF ABOUT 1,000, BUT 75,000 VISITORS STOPPED OFF HERE IN 1919. CASCADES MOUNTAIN (9,825 FT.) IS SEEN IN THE BACKGROUND

rane (alt. 3,750 ft.) is reached the traveller is well within the rounded, grassy foothills and river "benches," or terraces. Here the valleys are seen to cut the mountains transversely. Further on, in the main ranges, as distinct from the foothills, the valleys will be found running parallel with the mountains, north and south, and these valleys open into each other across the mountain ranges by the passes, the lowest of which is 5,000 feet above sea level, the highest 7,000 feet. Geologically the transverse valleys by which entrance is made to the mountains represent the grooved course of ancient glaciers, and many of the rivers flowing in these beds can be followed directly up to the remnants of these ancient glaciers. The remnant glacier of the Bow River today occupies a field thirty miles long by six to ten broad.

Extensive ranches are passed in rapid succession—great herds of horses in the lower valleys, thousands of cattle on the terraces, and flocks of sheep on the hilltops may be seen at once with sawmills and coal-mines visible from time to time.

Morley (alt. 4,078 ft.), is interesting to the tourist as the reservation of the Stoney Indians, once the most warlike tribe of the native races of America, but now one of the most industrious and peaceful. Approaching Kananaskis the mountains suddenly appear close at hand and, seemingly, an impenetrable barrier, their base deeply tinted in purple, and their sides flecked with white and gold, while high above, dimly outlined in the mists, are distant, snowy peaks.

The Kananaskis River (alt. 4,218 ft.), is crossed a little above where it joins the Bow and the roar of the great falls of the Bow (called Kananaskis Falls) may be heard. At Exshaw (alt. 4,261 ft.), the difference between the ordinary stream and a glacier-fed river is first noticed. Tumbling from great heights, the former may be foamy and tumultuous; but the latter is always milky-green with a sediment of glacial silt—infinitesimally fine particles formed by the grinding of the ice over the rocks. At the Gap (alt. 4,284 ft.), the mountains rising abruptly in great masses. This is the gap by which the Rocky Mountains are entered. Through this gateway the Bow River issues from the hills.

A remarkable contrast between the ranges ahead is noticeable. On the right are fantastically broken and castellated heights; on the left, massive snow-laden promontories, rising thousands of feet, penetrated by enormous alcoves in which haze and shadow of gorgeous colouring lie engulfed. Many ranges of prodigious mountains like these must be traversed before the Pacific coast is reached, and grandeur and beauty will crowd upon the attention without ceasing as the train speeds through gorge and over mountain, giving here a vast outlook and there an interior glimpse, then exchanging it for a new one with the suddenness of a kaleidoscope. Near Canmore are large coal mines and all along the embankments of the Bow River valley at this point are groups of isolated and curiously weathered conglomerate monuments, called "hoodoos"—giant earthen pillars, ten times the height of a man, in many cases. On either side of the beautiful level valley the mountains rise in solid masses westward, until the great bulk of Cascade Mountain closes the view. At Bankhead (alt. 4,581 ft.), the pass narrows suddenly, and as the mountains are penetrated the scenery becomes grander and more awe-inspiring. The walled masonry, shooting up in Seven Peaks, on the left is Rundle, called after an early missionary to the Indians. Here the line for a time leaves the Bow and strikes up the Valley of the Cascade.

Banff
Alt. 4,534 ft.,
Aug. 20-22

Banff is the station for the Canadian National Park—a Government reservation of 5,732 square miles and is situated at the junction of the Spray and Bow Rivers 82 miles west of Calgary. The village has a population of about 1,400 with a Government museum, a moving picture theatre and a bank, electric light and telephone; a good motor road, boating and golf are provided for the tourist while nature grants him splendid fishing, with Hot Sulphur Springs not far away. The park itself embraces parts of the valleys of the Bow, Spray and Cascade Rivers, Lake Minnewanka and several noble mountain ranges, the Yoho Valley and a varied country to the west and south. It is the largest in the world, being nearly half as large again as the famous Yellowstone Park in the States. No part of the Rockies exhibits a greater variety of sublime and pleasing scenery, and nowhere are good points of view and features of special interest so accessible as in this district where, also, many good roads and bridle paths have been constructed.

The railway station at Banff is in the midst of impressive mountains. The huge mass northward is Cascade Mountain (9,824 ft.); eastward is Mount Inglismaldie and the heights of the Fairholme sub-range, behind which lies Lake Minne-



LAKE LOUISE FROM THE CHATEAU SHOWING VICTORIA GLACIER AND MOUNT LEFROY. MOUNT VICTORIA IS 11,355 FT. HIGH AND MOUNT LEFROY 11,220. THE RIDGE IS FIVE MILES BY AIR LINE FROM THE HOTEL TERRACE

wanka. Up the Bow, westward, tower the distant, snowy, central heights of the main range about Simpson's Pass, most prominently, the square, wall-like crest of Mount Bourgeau. A little nearer, at the left, is seen the northern end of the Bourgeau range, and still nearer, the razor-like back of Sulphur Mountain, along the side of which are the Hot Springs, and on whose summit (7,455 feet), an observatory has been established; just behind the station Mount Rundle (9,798 feet), rises sharply. At this point the train passes along a large corral of 800 acres in which are about 100 buffaloes, among the last specimens of the monarchs of the plains. In well-constructed cages are other specimens of the various wild animals found in the Rocky Mountains.

The village of Banff is a short distance south-west of the station and the C.P.R. Banff Springs Hotel about a mile further on. A steel bridge takes the carriage-road across to the hotel, which is located on an eminence between the foaming falls on the Bow and the mouth of the rapid Spray River. In direct connection with the hotel there has been opened what is probably the finest bathing establishment on the continent. It is built in the form of three terraces, the outer and lowest one of which forms a great semi-circular swimming pool, which is 120 feet in diameter and varies from three to seven feet in depth. The second terrace contains a sheltered warm sulphur-water pool, which is supplied by piping water direct from the Hot Springs on Sulphur Mountain at the rate of 1,165 gallons per hour.

Adjoining the sulphur plunge there are ten shower baths and complete Turkish and Russian baths, finished in marble. One hundred dressing-rooms are provided at this level, and on the third terrace, there are the cooling rooms, private sulphur baths, etc., with a roof which forms a wide promenade, with chairs placed to enable guests to obtain both a view of the bathers below and of the whole magnificent panorama of the mountains.

Still another attraction at Banff is the new golf course. Nestling among the mountains, completely surrounded by gigantic peaks, and with the glacier-fed Bow River flowing throughout its length, the course is superbly located. Nine miles from Banff is Lake Minnewanka and at the upper end of the lake is the valley of the Ghost River, a strange region where the mountain rivulets gurgle off into subterranean reservoirs and the granite walls are pitted with caves. Between Banff and the lake is Bankhead, where are located the anthracite mines, operated by the C.P.R., whose output will eventually provide the country as far east as Winnipeg with fuel. The Hot Springs are at different elevations upon the eastern slope of Sulphur Mountain, the highest being 900 feet above the Bow.

Lake Louise
Alt. 5,044 ft.
Aug. 22

Upon leaving Banff the railway rejoins the Bow and follows it up through a forested valley. The Vermillion lakes are skirted, and ahead an excellent view is had to the right of Mount Bourgeau and the snow-peaks far to the west, enclosing Simpson's Pass. Then a sharp turn discloses, straight ahead, the great heap of snowy ledges that form the eastern crest of Pilot Mountain, 9,680 feet, the landmark of mountain trappers, for it is seen and easily recognizable from both ends of the Bow Valley. Hole-in-the-Wall Mountain is passed upon the right, against whose side can be seen a cavernous opening to a large mountain grotto.

A little beyond Mount Castle station (alt. 4,657 ft.) Castle Mountain looms up ahead, on the right, a sheer precipice of 5,000 feet—a giant's keep, stretching for eight miles, with turrets, bastions and battlements complete. A natural drawbridge, portcullis and gateway can be plainly distinguished against this ochre wall. The back of this mountain is a gradual slope, glacier-covered and overlooking a wild region of canyon, torrent and bridges of rock. After passing this point, the mountains on each side become exceedingly grand and prominent. Those on the right (north-east) form the bare, rugged and sharp serrated Sawback sub-range, with a spur, called the Slate Mountains, in the foreground of Lake Louise. On the left, the lofty Bow range fronts the valley in a series of magnificent snow-laden promontories. At first, enchanting glimpses are caught only through the trees, as you look ahead; but before Eldon is reached, the whole long array is in plain view. Turning to the left, and looking back, the central peak of Pilot Mountain is seen, like a leaning pyramid, high above the square-fronted edges visible before. Next to it is the less lofty, but almost equally imposing cone of Copper Mountain, squarely opposite the sombre precipices of the Castle.

Westward of Copper Mountain, the top of Vermillion Pass opens through the range, permitting a view of many a lofty spire and icy crest along the continental



MORAINE LAKE, THE VALLEY OF THE TEN PEAKS, NINE MILES FROM LAKE LOUISE—
"AN EMERALD GEM IN A GLACIER SETTING"

watershed, from whose glaciers and snowfields the Vermillion River flows westward into the Kootenay. Most prominent on the east side are the precipitous face of Storm Mountain (10,309 ft.) and the snow dome of Mount Ball (10,825 ft.). West of the entrance into Vermillion Pass, towering up tier after tier, is a chaotic sea of mountains, and beyond, standing supreme over this part of the range, is the prodigious, isolated, helmet-shaped mountain named Temple (11,626 ft.)—the loftiest and grandest in this whole panorama. This great snow-bound mountain, whose crest exhibits precipitous walls of ice flashing blue in the sunlight, becomes visible at Sawback station, and from Eldon almost to the summit its white-crowned precipice is the most conspicuous and admirable feature of the wonderful valley.

Lake Louise is the station for the Lakes in the Clouds—rare gems whose loveliness and charm surpass description. On the margin of Lake Louise, there is a Canadian Pacific hotel recently much enlarged, where excellent accommodation is provided. A good trail entirely surrounds Lake Louise and there is a bridle-path to Mirror Lake, 6,655 feet up the mountain, and a still further ascent to Lake Agnes during which a magnificent view of the Bow valley and the surrounding mountains is obtained. Both lakes lie literally above the clouds, nestling in the rocky cirques among the peaks of the Beehive, St. Piran, Niblock and Whyte. Trails also lead across the stream draining Lake Louise to Fairview Mountain on the left side and to the Saddleback still farther eastward, from which one can look across an abysmal gorge 2,000 feet deep to the avalanches of Mount Temple, the forested vale called Paradise Valley, the scarred battlements of Mount Sheol and the pinnalced heights of Castle Crags, behind Fairview Mountain. A good carriage road has been built from the C.P.R. hotel to Moraine Lake and the Valley of Ten Peaks.

Beyond Lake Louise the railway leaves the Bow and ascends a tributary from the west, which courses through a gap in the Bow range. Looking upward to the right (north-west), towards Bow Lake and the huge rounded snow-capped peak of Mount Daly, a view is obtained of the glacier. It is a broad, crescent-shaped river of ice, the further end concealed behind the lofty yellow cliffs that hem it in. It is 1,300 feet above and a dozen miles away. Further north are other glacial fields, one of which is the source of three great continental rivers, flowing to three different oceans—the Athabasca or Mackenzie River flowing to the Arctic, the Saskatchewan to the Atlantic, and the Columbia to the Pacific. This glacier presents some exceptionally interesting features, among others an enormous cavernous passageway, the size of a railway tunnel, cut out by subterranean rivers. This is also the region of Mounts Columbia, Bryce, Athabasca and Forbes.

The Great Divide

The stations of Stephen (alt. 5,326 ft.) and Hector (alt. 5,213 ft.) follow with a passing from the Province of Alberta into that of British Columbia at "The Great Divide," where a sparkling stream separates into two rivers—the waters of one flowing to the Pacific and those of the other to Hudson Bay. At this point is seen the granite shaft erected to the memory of Sir James Hector, discoverer of the Kicking Horse Pass by which the trains cross the highest range of the Rockies; from Lake Louise there is visible the great Hector Mountain, also called after him. From Stephen the line descends rapidly, passing the beautiful Wapta Lake at Hector and crossing the deep gorge of the Kicking Horse River just beyond. The line clings to the mountain-side to the left, and the valley on the right rapidly deepens until the river is seen as a gleaming thread 600 feet below. Above is a serrated skyline whose craggy margin hides the glaciers and the real summit of the range.

Looking to the right, the Yoho, one of the grandest mountain valleys in the world, stretches away to the north, with great, white, glacier-bound peaks on either side. Looking forward to the right, the heights of Mount Field are seen. On the left, the basilica-like spires of Cathedral Mountain loom against the sky, and just beyond is the dome-like head of Mount Stephen, called after the first President of the C.P.R. On its shoulder is seen a vast, shining, green glacier, the forepart of this monster, which hangs obliquely forward, measuring nearly a thousand feet in length, and its lower outer edge showing a vertical depth of almost a hundred feet. Here, too, can be seen a silver-lead mine on the mountain-side, 2,500 feet above its base.

Coming from the east, the road first enters the corkscrew tunnel of 3,200 feet, under Cathedral Mountain. Emerging from the tunnel twist, the track runs back east across Kicking Horse River, and then enters the eastern spiral tunnel of 2,910 feet under Mount Ogden, and after describing an elliptic curve emerges so

AN EMERALD GEM IN A GLACIER SETTING"



MOUNT ASSINIBOINE, CANADIAN ROCKIES, THE MOST SPECTACULAR PEAK IN THE CANADIAN PACIFIC ROCKIES—ALTITUDE 11,800 FEET, THREE DAYS BY PONY TRAIL FROM BANFF

as to again cross the Kicking Horse westward. The whole thing is a perfect maze, the railway doubling back upon itself twice, tunnelling under mountains and crossing the river twice in order to cut down the grade. It is not merely a great piece of tunnelling, but the first introduction of this spiral system of tunnels on this continent.

Field is the next point reached and here, at an altitude of 4,072 feet, the Alberta division of the C.P.R. terminates and the trains travel on Pacific time — an hour earlier than Mountain time. At Field is the Mount Stephen House, formerly a C.P.R. hotel but now a Railway Y.M.C.A.—not far from the base of Mount Stephen and facing Mount Field. This place combines all possible attractions for the mountain tourist. From here is reached that great glacier field first seen northward from Lake Louise; there is excellent fly-fishing for trout in the lakelets and streams near the village; 2,500 feet up the right-hand slope of Mount Stephen, a long and easy bridle-path, is a wonderful fossil bed of limestone slabs, which, for the most part, consist of thin, laminated plates or layers. On a sharp knock the layers separate, revealing countless fossil specimens, fern-like and perfectly marked, principally trilobites and agnostus.

Looking down the valley from the station, Mount Dennis is seen on the left, and the Van Horne Range on the right. The two most prominent peaks of the latter are Mounts Deville and King, the former on the right. The Ottertail group with its sheer wall, snow caps and abrupt declivities giving unexpected views at every turn, is particularly attractive to the climber. Nor far away is the gorge of the marvellous Takakkaw Falls in the Yoho Valley which are amongst the finest in the known world. An enormous volume of seething, boiling water rushes over the precipice on the far side of the narrow gorge and descends the rock side in clouds of foam, a sheer drop of 1,200 feet. The Takakkaw Falls is one of the most striking attractions in the mountains and ought not to be missed by any tourist. The C.P.R. operates a small but attractive chalet hotel at Emerald Lake, seven miles by road from Field—a convenient outfitting point for the Yoho Valley.

Two miles beyond Field, very lofty, glacier-bearing heights are seen at the north. The line follows the Kicking Horse, whose narrow valley divides the Ottertail and Van Horne ranges; Mount Goodsir (11,676 ft), the highest of the Ottertail group, is seen from Ottertail Creek. The line, which has gradually curved towards the south since crossing the summit at Stephen, runs due south from here to Leanchoil, where the Beaverfoot River comes in from the south and joins the Kicking Horse. At the left, the lofty peaks of the Ottertail Mountains, walled, massive and castellated, are still in view and rise abruptly to an immense height; and, looking south, a magnificent range of peaks extend in orderly array towards the southeast as far as the eye can reach. These are the Beaverfoot Mountains, appearing to slope away from the railway. At the right Mount Hunter, a long, gradual slope, pushes its huge mass forward like a wedge between the Ottertail and Beaverfoot ranges. The river turns abruptly against its base and plunges into the lower Kicking Horse canyon, down which is disputes the passage with the railway.

Here the canyon rapidly deepens until, beyond Palliser, the mountain sides become vertical, rising straight up thousands of feet, in a bronze wall crested by a long line of unnamed peaks, and within an easy stone's throw from wall to wall. Down this vast chasm go the railway and river together, the former crossing from side to side to ledges cut out of the solid rock, or twisting and projecting angles of rock which seem to close the way. The towering cliffs almost shut out the sunlight and the roar of the river and the train increase an hundredfold by the echoing walls.

Glenogle (alt. 3,008 ft.), is passed and suddenly the train emerges into sunlight and Golden is reached with Moberly not far away. The broad river ahead is the Columbia moving northward. The supremely beautiful mountains beyond to the left and south are the Selkirks, rising from their forest-clad bases and lifting their ice-crowned heads far into the sky. They extend in an apparently unbroken line from the southeast to the northwest, gradually melting into the remote distance. Parallel with them and rising eastward, to the right and north from the Columbia, range upon range, are the Rockies, only the loftiest peaks to be seen just now over the massive benches upon which they rest. Golden is a lumbering town of 1,000 people, upon the banks of the Columbia, at the mouth of the Kicking Horse. It is a gateway to the beautiful Lake Windermere district at the headwaters of the Columbia River, and the C.P.R. here provides a home for its corps of Swiss Alpine guides in a model village called Edelweiss. A side

trip has been arranged to Lake Windermere Camp, an attractive summer resort opened this year.

Lake Windermere Aug. 23

From Golden to Donald the railway follows down the Columbia on the face of the lower bench of the Rocky Mountains, the Selkirks all way in full view opposite, the soft green streaks down their sides indicating the paths of avalanches. The first point of special interest is Moberly with the oldest cabin in the mountains, seen to the left of the track, where a Government engineering party, under Walter Moberly, C.E., engaged in the preliminary surveys of the railway route, passed the winter of 1871-2. The station of Donald lies in the shadow of the Selkirks. From here the railway crosses the Columbia to the base of the Selkirks, always wooded in contrast to the naked stone of the Rockies. A little further down, the Rockies and Selkirks, crowded together, force the river through a deep, narrow gorge, the railway clinging to the slopes high above it.

Emerging from the gorge at Beavermouth, the most northerly station of the C.P.R. route, the line soon turns abruptly to the left and enters the Selkirks through the Gate of the Beaver River—a passage so narrow that a felled tree serves as a foot-bridge over it—just where the river makes its final and mad plunge down to the level of the Columbia. Here a natural bridge is seen across the boiling torrent. The stations of Six Mile Creek, Cedar, and Bear Creek follow with a rising altitude to 3,663 feet at the latter point. Meanwhile, and a little way up the Beaver the line crosses to the right bank, where, notched into the mountain side, it rises at the rate of 116 feet to the mile, and the river is soon left a hundred feet below, looking like a silver thread as it winds through the narrow and densely, forested valley. Opposite is a line of huge tree-clad hills, occasionally showing snow-covered heads above the timber line. Nature has worked here on so gigantic a scale that many travellers fail to notice the extraordinary height of the spruce, Douglas fir and cedar trees, which seem to be engaged in a vain competition with the mountains themselves.

A little further on, Cedar Creek is crossed and not far west of it is a very high bridge, spanning a foaming cascade, whence one of the most beautiful prospects of the whole journey is to be had. So impressed were the builders with the charm of this magnificent picture of mountains that they named the spot The Surprise. The principal difficulty in construction on this part of the line was occasioned by the torrents, many of them in splendid cascades, which come down through narrow gorges cut deeply into the steep slopes along which the railway creeps. The greatest of all these bridges crosses Stony Creek—a noisy rill, flowing in the bottom of a narrow V-shaped channel, 300 feet below the rails—one of the loftiest railway bridges in the world. As Bear Creek station is approached, a brief but precious glimpse is caught of Mount Tupper through a gap in the cliffs on the right. This spot is 1,000 feet above the Beaver, whose upper valley can be seen penetrating the mountain southward for a long distance.

The line here leaves the Beaver and turns up Bear Creek along continuous grades of 116 feet to the mile. Many of the difficulties of the railway, from snow in the winter, occur between Bear Creek and the summit on the east and for a similar distance on the west slope of the Selkirks, and these have been completely overcome by the construction, at vast expense, of sheds, or, more properly, tunnels, of massive timber work. These are built of heavy squared cedar timber, dovetailed and bolted together, backed with rock, and fitted into the mountain sides in such a manner as to bid defiance to the most terrific avalanche. Beyond Stoney Creek Bridge, the gorge of Bear Creek is compressed into a vast ravine between Mt. Macdonald on the left and Mount Tupper on the right, forming a narrow portal to the amphitheatre of Rogers' Pass, at the summit.

The cowled figured of a man, with his dog, on the western edge of one of the crags, shapes itself out of the rocks, and gives the name of Hermit to this range. The way is between enormous precipices. Mount Macdonald towers a mile above the railway in almost vertical height. Here the C.P.R. has constructed a double-track tunnel through the Selkirk range. Out of compliment to H.R.H. the Duke of Connaught, five years Governor-General of Canada, this was named the Connaught Tunnel. From portal to portal its centre line measures 26,400 feet, thereby exceeding by three-fourths of a mile the longest existing tunnel in America.

Rogers Pass was named after Major A. B. Rogers, by whose adventurous energy it was discovered in 1881, previous to which no human being had penetrated to the summit of its great central range. The Pass lies between two lines of huge snow-clad peaks. That on the north forms a prodigious amphitheater, under

whose parapet, five or six thousand feet above the valley. half a dozen glaciers may be seen at once, and so near that their shining green fissures are distinctly visible. In this direction, also, may be seen a group of sharp serrated peaks, clear-cut against the sky. The tallest is Swiss Peak, so called in honor of the Swiss Alpine Club which first stood upon its highest pinnacle. The changing effects of light and shadow on this brotherhood of peaks, of which Tupper and Macdonald are among the chief, will never be forgotten by the fortunate traveller who has seen the sunset or sunrise tinting their battlements, or has looked up from the green valley at a snowstorm trailing its curtain along their creats

The railway used to climb over the open pass, but now bores its way through the tunnel underneath it, in this way eliminating many miles of snowshed. It emerges from the tunnel on the Pacific slope of the Selkirks at Glacier, named after the Illecillewaet Glacier, a vast cascade of gleaming ice falling 4,500 feet from the summit of the snow-field in which it has its source—one glacier of a group of glaciers all together—the ice-field, of which the Illecillewaet is one of a number of outlets, embracing an area of ten square miles.

Sir Donald (10,808 ft.) rises a naked and abrupt pyramid, to a height of a mile and a quarter above the railway. This stately monolith was named after the late Sir Donald Smith (Lord Strathcona), one of the promoters of the C.P.R. Farther to the left are sharp peaks—Uto, Eagle, Avalanche and Macdonald—second only to Sir Donald. Somewhat at the left the shoulders of Ross Peak are visible over the wooded slope of the mountain behind the hotel, which is called Abbott. Between Ross and Abbott, in the background, is an enormous wall of snow. This is the Mount Blonney Glacier. To the right of Ross, a glimpse is caught of the Cougar Valley where are the wonderful caves of Nakimu.

Turning again to face the great Illecillewaet Glacier, a "V"-shaped valley is seen on the right. This is the valley of the Asulkan Brook, a gem of mountain beauty, where a series of white cascades foam through vistas of dark spruce and fir, where falls leap from ledges above in clouds of flying spray, and shining open meadows lead the traveller to listen for the tinkle of the Alpine herd. The peaks, going from right to left, are: Afton, the sharp apex; the Rampart, an oblong wall; the Dome, a rounded rock; Castor and Pollux, two sharp spires farthest south. To the left of the Asulkan Glacier comes a forested dome, Glacier Crest, the western boundary of the Great Illecillewaet Glacier, which is banked on the other side by the lower slopes of Sir Donald, from whose summit an immense number of glaciers can be seen. The summit of the Selkirk range, as crossed by the railway and the nearby village of Rogers Pass (distance four miles) are reached from Glacier by a fine pony trail, and from here the trail to Roger's Amphitheatre may be taken. Game is very abundant throughout these lofty ranges, whose summits are, in particular, the home of the mountain goat.

Continuing the descent from Glacier, and following around the mountain-side, Loop is soon reached, where the line makes several startling turns and twists, first crossing a valley leading down from the Mount Bonney glacier, touching, for a moment, on the base of Ross Peak, then doubling back to the right a mile or more upon itself; then sweeping around to the right, touching Mount Cheops, on the other side of the Illecillewaet, crossing again to the left, and at last shooting down the valley parallel with its former course. Looking back, the railway is seen cutting two long gashes, one above the other, on the mountain slope, and, further to the left, the Summit range, near Rogers' Pass, is yet visible, with Sir Donald overlooking all. The Illecillewaet River is here of no great size, but, of course, turbulent. Its water is at first pea-green with glacial mud, but rapidly clarifies. About Ross Peak station are many silver mines penetrating the crest of one of the lofty hills north of the railway, and a series of interesting caves have recently been discovered about 2,000 feet above the track.

There is a station at Illecillewaet and one at Albert Canyon. Just east of this latter point the train runs suddenly along the very brink of several remarkably deep fissures in the solid rock, whose walls rise straight up, hundreds of feet on both sides, to wooded crags, above which sharp, distant peaks cut the sky. The most striking of these canyons is the Albert, where the river is seen nearly 150 feet below the railway, compressed into a boiling flume scarcely 20 feet wide. Twin Butte station (alt. 1,877 ft.) takes its name from the huge double summit nearby, now called Mounts Mackenzie and Tilley. After passing the station, there looms up at the right the conspicuous and beautiful range named Clachnacoodin; from here descent to the base of the Selkirks and the rich mining camps of the Kootenays is rapid, with Revelstoke, B.C., as the northern gateway.



MOUNT SIR DONALD AND THE ILLECILLEWAET GLACIER

THE PROVINCE OF BRITISH COLUMBIA

The Province of British Columbia

At "The Great Divide," shortly after leaving Lake Louise, the train passes imperceptibly from Alberta to British Columbia. The greater part of the vast, rolling sea of mountains is, however, in the Pacific Province; to it, in the main, belongs the greatness and glory of the scenery, the riches of the mineral product averaging $35,000,000 a year in later days and a total of $670,000,000 since mining was first attempted; to it pertains the responsibilities of transportation and development in a province of such enormous natural difficulties for a population of 392,000 people. Of course, the Dominion has aided in this connection and three great transcontinental lines have brought the once isolated "sea of mountains" into the prosperous circle of Canadian progress.

The area of British Columbia is 395,000 square miles and it is larger than the three Pacific Coast States of California, Oregon and Washington together or than the United Kingdom, France, Belgium and Holland combined. Throughout a considerable part of the mountainous country and especially in the Gold, Selkirk and Coast ranges much mining has been done—notably in the Caribou, Omenica and Cassiar regions. Everywhere are plateaus or valleys lying like troughs in the sea between the great masses of lofty land; usually they have rivers running through their lengths, or depths, and frequently soil of great fertility. Of these the Kootenay and Columbia Valleys are the most conspicuous and the B.C. Department of Agriculture has reported that they contain "two-thirds more cultivable lands and much more timber and pasture lands than Switzerland, together with a wealth of minerals"; yet Switzerland supports a population of 3½ millions and produces yearly 2,000,000 head of live-stock and large quantities of food products. The Okanagan Valley, the Similkameen, the Kettle River, the Nechako and Bulkley Valleys are other notable regions in fertility and fruit-growing possibilities.

The Fraser River Valley is in a class by itself and the Vancouver and Queen Charlotte Islands along the coast—the former the seat of the provincial capital, and the home of great natural resources—possess enough undeveloped wealth to support a small nation. There are, in fact, millions of acres of arable land in the province—an official estimate is 20,000,000—and very large areas of pasture land; they only require railway connection and many of the chief valleys now have it. The estimated value of actual agricultural production in 1919 was $99,000,000. The rivers of British Columbia are as remarkable as its mountains and the Kootenay (400 miles), the Columbia (465 miles in Canada), the Fraser (695 miles) and a part of the Peace are mighty adjuncts to future development and to the present scenery and sport or to navigation and transportation amongst lofty peaks and rugged hills and beautiful valleys. Smaller rivers—great ones they would be in most countries—are the Thompson (305 miles), the Nass (205 miles), the Skeena (335 miles) and Stikine (335 miles), Stewart (320 miles), and Pelly (330 miles).

As to the coast line of 7,000 miles, with its vast fisheries and army of harbours, Lord Dufferin once wrote: "Such a spectacle as its coast line presents is not to be paralleled by any country in the world. Day after day for a whole week, in a vessel of nearly 2,000 tons, we threaded an interminable labyrinth of watery lanes and reaches that wound endlessly in and out of a network of islands, promontories and peninsulas for thousands of miles, unruffled by the slightest swell from the adjoining ocean and presenting at every turn an ever-shifting combination of rock, verdure, forest, glacier and snow-capped mountain of unrivalled grandeur and beauty. When it is remembered that this wonderful system of navigation, equally well adapted to the largest line-of-battle ship and the frailest canoe, fringes the entire seaboard of the province and communicates, at points sometimes more than 100 miles from the coast, with a multitude of valleys stretching eastward into the interior, while at the same time it is furnished with innumerable harbours on either hand, one is lost in admiration at the facilities for intercommunication which are thus provided for the future inhabitants of this wonderful region."

MOUNT SIR DONALD AND THE ILLECILLEWAET GLACIER

Through the Mountains to the Coast

The climate of British Columbia is mellowed and moulded by the Japan current of the Gulf Stream of the Pacific; the winters are mild and moist, snow seldom falls or stays long when it does come; soft, warm, moist sea winds blow up the long inlets and rivers and modify the climate of central and northern plateaus; the most northern islands and the coast near them have a milder climate than Scotland and the more southern regions and Vancouver Island resemble parts of England in this respect. In British Columbia are to be found almost every known mineral. There is gold in many of the rivers and streams and placer and quartz mining are going on steadily—though as yet only the fringe of production has been touched; silver, copper, zinc and lead are present in immense quantities and in 40 mining divisions they now support several smelters; coal is everywhere, in all quantities and immense quantities, with the Crow's Nest Pass fields and their estimated ore of 23,000 million tons in an area of 230 square miles and the one-time Dunsmuir Collieries on Vancouver Island as the best-known. Other areas are at Michel, Princeton, the Tulmeen Valley, Nicola and Telkwa Valleys with the Comox and Nanaimo fields on Vancouver Island.

The province is famous for the size and number of its trees, the superior quality of its timber and possession of the last and greatest area of compact forests in North America. The area has been estimated at 180,000,000 acres, but an official British Columbia Report in 1910 stated that only a portion of this area was covered with merchantable timber; a later Dominion official figure is 47,000,000 acres of commercial timber made up of Douglas fir, western cedar, sitka spruce, larch, balsam, hemlock and maple; as to quantity 240 billion feet is a reasonable estimate with very rapid natural growth and a yearly timber cut of about 1,500 million feet by 425 saw-mills and a value (1916) of $13,000,000.

Taking this rich province as a whole, with its scattered populations in the heart of or upon the verge of great mountain ranges, or scattered along a tremendous coast-line from Vancouver to Prince Rupert, it possesses almost everything calculated to make a people prosperous and contented. The southern valleys, southern Vancouver Island and the Fraser delta offer choicest fruit lands; cattle ranges dot the central and southern plateaus and in the drier belts there is ample water for further irrigation with an estimated hydraulic energy of 2,500,000 h.p. of which only 300,000 h.p. has yet been developed. There is a great pulp industry, especially on Vancouver Island; the fisheries are limitless in resource with the famous salmon pack and halibut catch as the basis of a $21,000,000 yearly product; there are extensive dry-docks and repair yards at the ports of the province and Vancouver is hundreds of miles nearer Yokohama, Vladivostok, Hong Kong and Shanghai in the Orient than is San Francisco; the trade of the province in 1919 was $77,247,666 of exports and $63,694,691 of imports with bank clearings which totalled $804,018,563, and bank branches numbering 214; the industrial production (1917) was $171,425,516.

At the western base of the Selkirk the narrow valley becomes a gorge, and the C.P.R. and the Columbia River dispute the passage through a chasm with vertical rocky walls standing but ten yards apart. The line then suddenly emerges into a comparatively open, level and forest-covered space, swings to the right and reaches Revelstoke, the northern gateway to the rich mining camps of West Kootenay. At an altitude of 1,492 feet the first important mining town of British Columbia is reached. Revelstoke has a population of 3,500 and is a splendid tourist resort with fishing, hunting, boating and mountain climbing to choose from; it is the county capital of West Kootenay and a divisional point on the C.P.R., and does a large supply trade with local mining camps; in the neighbourhood are minerals in immense quantities—silver, lead, gold and copper with lumber, pulpwood, brick clay; it has four churches, three banks, railway repair shops, sash and door factory, saw-mills.

On Mount Revelstoke, immediately north of the city, the Provincial and Dominion Governments are building a fine automobile road, 18 miles in length. On the summit of this mountain is one of the most beautiful Alpine parks to be found anywhere. A comfortable chalet has been provided for the accommodation of tourists. The Columbia, which has made a great detour around the northern extremity of the Selkirks, while the railway has come directly across, is here much larger than at Donald, from which it has fallen 1,071 feet, and 28 miles below Revelstoke it expands into the Arrow Lakes, along which there is much beautiful country and where the opportunities for sport are unlimited.

Succeeding stations are Clanwilliam (alt. 1,820 ft.), Three Valley (1,636), Craigellachie (1,225), Malakwa (1,215), Bowie, Sicamous (1,153), Salmon Arm

(1,157), Notch Hill (1,691, Squilax (1,288, Chase (1,183), Shuswap (1,153), Ducks (1,154) and Kamloops a very important centre which will be visited on the return trip. In resuming the journey the two peaks southeast are Mackenzie and Tilley. The mountains beyond are in the Gold or Columbia range and the most prominent one in view, toward the southwest, is Mount Begbie, imposing and glacier-studded. The Columbia is crossed, and the Gold range is at once entered by Eagle Pass, which is very deep-cut and direct; lofty mountains rise abruptly on each side throughout, and the Pass is seldom more than a mile wide. The highest point reached in this pass is Summit Lake, seven miles from, and only 400 feet above, the Columbia.

Four beautiful lakes—Summit, Victor, Three Valley and Griffin—occur in close succession, each occupying the entire width of the valley, and forcing the railway into the mountain sides. The valley is filled throughout with a dense growth of immense trees—spruce, Douglas fir, hemlock, cedar, balsam and many other varieties—giants, all of them. Sawmills occur at intervals. At Craigellachie the last spike was driven in the C.P.R. on Nov. 7, 1885—the rails from the east and the west meeting here. Here there are famous sporting regions. Northward, within a day, caribou are abundant; the deer shooting southward within a reasonable distance is very good, and on the Shuswap Lakes there is sport in deep trolling for trout during the proper season.

Salmon Arm rests on Shuswap Lake and has about 3,500 population; it boasts a storage plant with 25 carloads capacity; it has a co-operative creamery and the Farmers' Exchange handles local products; it is the centre of a fruit-growing, dairying and mixed farming region.

Sicamous is the station for the mining and agricultural districts to the south, where there is a large settlement. A branch railway runs from here to Vernon and the head of Lake Okanagan, a magnificent sheet of water on which a steamer plies to Kelowna and to Penticton, at the foot of the lakes.

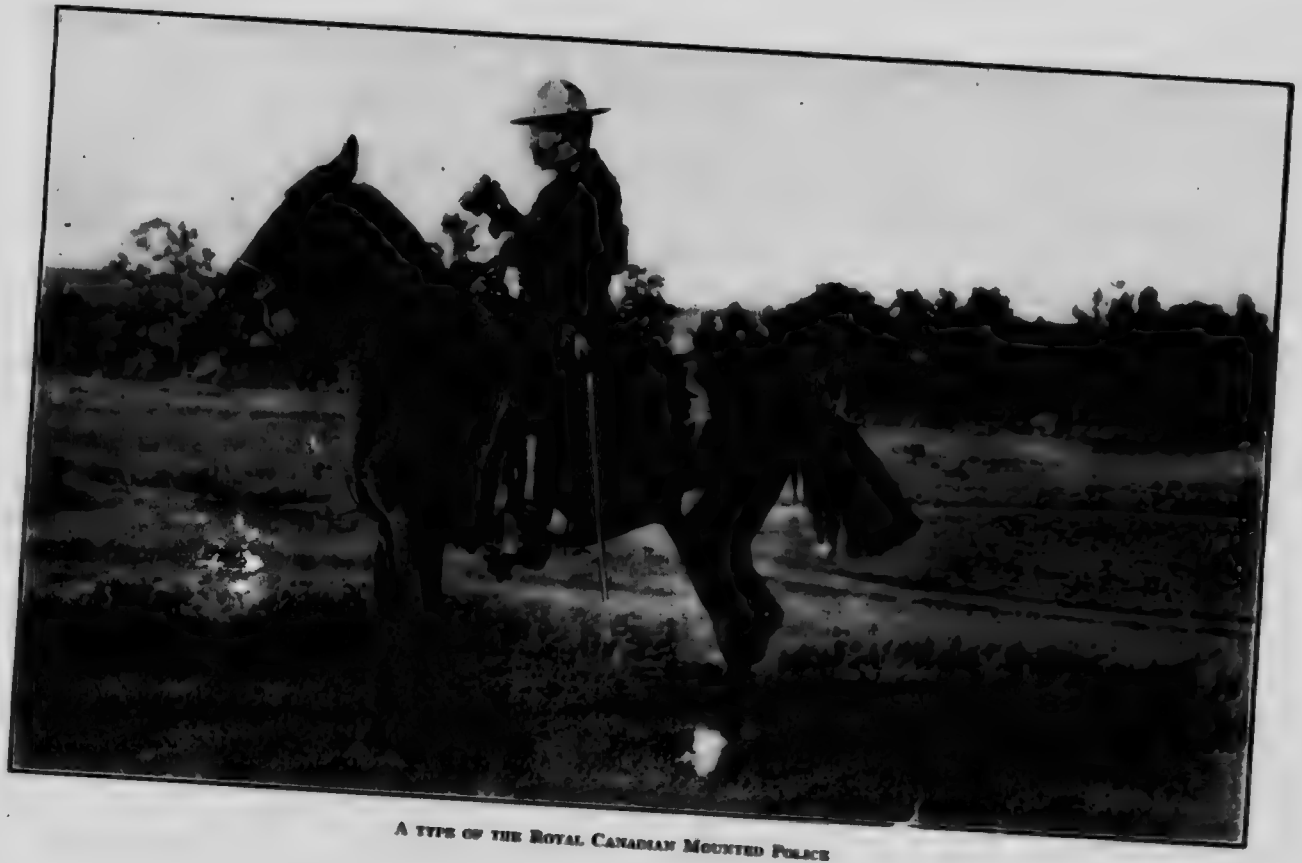
The Okanagan Valley Aug. 24

In this Okanagan Valley trip from Sicamous there is much of beauty and fruitful soil to be seen as well as the vast environment of mountain scenery which looms up in the distance. Mara and Grindrod are first passed and then Enderby is reached; it has a population of 800, four churches, schools, banks, a hospital and several industries with a surrounding country rich in diarying, fruit, lumber and water power; there is here, as all through the Valley, excellent fishing, big and small game. Armstrong is the next point and it has about 1,500 people with six churches and all the various municipal interests and conveniences; it has in addition three produce exchanges, a rifle range and domestic science and manual training in its schools.

After passing Larkin, the town of Vernon is reached five miles from Okanagan Lake, and 46 miles south of Sicamous. It has daily steamboats to southern points, several hotels, seven churches and various county buildings, schools, banks, theatres, etc.; its industries include sashes and doors, sawmill and cigars, canning factory, cider, etc.; it has municipally-owned utilities. City, automobile, country and golf clubs and fine roads; it is the commercial centre of the district and its fruit-selling centre as well with large produce warehouses. The population is about 3,500 and a short distance to the last is the well-known Coldstream ranch of 13,000 acres of orchard land which Lord Aberdeen, when Governor-General, established and cultivated, and controlled until quite recently, when it was sold. The country around here has been described as an earthly paradise.

Okanagan Landing, Whiteman, Killiney, Ewing, Sunnywold, Fintry, Nahum, Okanagan Centre and Wilson are succeeding villages and then comes Kelowna, on Lake Okanagan, with a population of 3,000, five churches and three banks, schools and hospitals, an exhibition building and race-track; it has a municipal park with a mile of lake frontage, several clubs and athletic associations of all kinds; it possesses several industries but, above all, are its orchards and gardens, its mild, dry climate and the 50,000 acres of rich fruit lands tributary to it. Peachland and Summerland, Naramata and Penticton follow; the latter are centres of land irrigation and fruit cultivation and Penticton is a town of 3,000 people with the usual large proportion of five churches, schools and lumber yards, saw-mills and fruit canneries; it has, also, a $2,000,000 oil flotation mill, a gun club and aquatic club, while the whole region has excellent hunting and fishing.

Returning again to the direct railway line at Sicamous, the journey continues through beautiful scenery and a veritable sportsman's paradise until, in the



A type of the Royal Canadian Mounted Police

Thompson River Valley, rocks and roughness or sombre scenes of splendour are exchanged for grass, fenced fields, growing crops, haystacks and good farm houses on a level surface, while herds of cattle, sheep and horses roam over the valley and bordering hills. Kamloops is the chief town of the valley. The Canadian National Railways have now approaching completion a branch line from Kamloops to Kelowna, a distance of 150 miles, which will open up for development extensive areas of fertile virgin lands.

Nearing the Coast

Tranquille and Cherry Creek, Savona and Walhachin, Ashcroft and Spatsum, Spence's Bridge and Drynoch, Thompson, Gladwin, Lytton, Keefers, North Bend, Spuzzum, and Yale are passed in a rapidly descending level—from 1,134 to 215 at Yale. Just below Kamloops the Thompson widens out into Kamloops Lake, a broad beautiful, hill-girt sheet of water, along the south shore of which the railway runs some twenty miles. Half-way a series of mountain spurs project into the lake and are pierced by numerous tunnels, one following the other in close succession. At Savona the lake ends, the mountains draw near and the series of Thompson River canyons is entered, leading westward to the Fraser through scenes of marvellous splendour. Quicksilver mines of great value are being operated in this locality.

From here to Port Moody, the nearest point of Pacifi tide-water, the railway was built by the Government and transferred to the present company in 1886. Ashcroft has developed into a busy town. There are extensive cattle ranches in the vicinity and considerable farming is done. Three miles beyond Ashcroft the hills press close upon the Thompson River, which cuts its way through a winding gorge of almost terrifying gloom and desolation, fitly called the Black Canyon. Opposite Spence's Bridge the old wagon road up this valley to the Caribou gold country may be seen; and the railway is here thrown over the mouth of the Nicola River whose valley, to the south, is an important grazing and ranching region into which the Kettle Valley Railway has been built to Nicola, Merritt, Penticton, Midway, and so on, to Nelson.

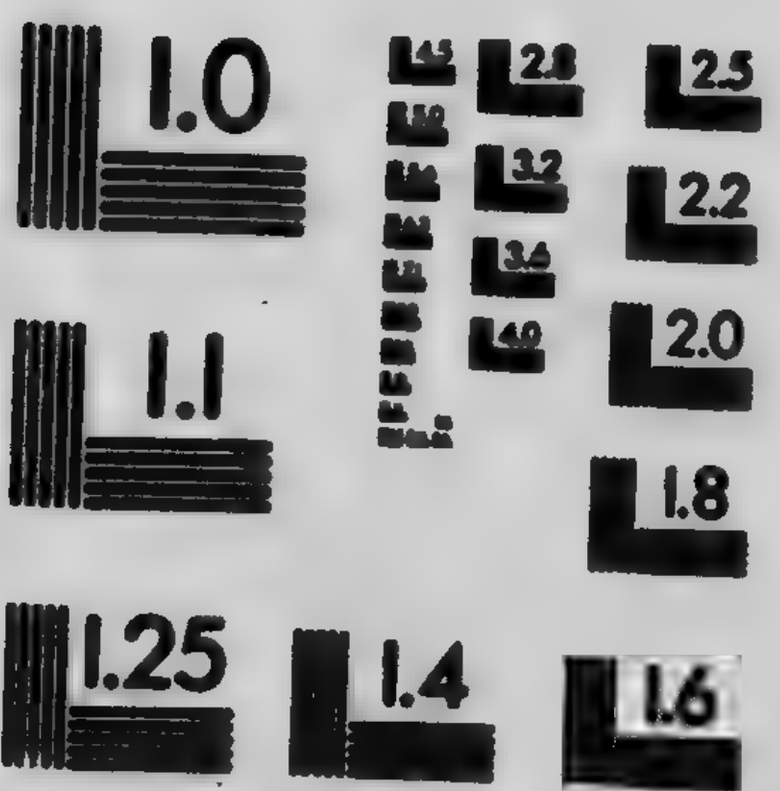
Below this point the scenery becomes very striking and peculiar. The train runs upon a sinuous ledge cut out of the bare hills on the irregular south side of the stream, where the headlands are penetrated by tunnels, and the ravines spanned by lofty bridges, and the Thompson, in the purity of a trout brook, whirls down its winding torrent path as green as an emerald. Sometimes the banks are rounded, cream-white slopes; next, cliffs of richest yellow, streaked and dashed with maroon, jut out; then appear masses of solid rust-red earth, suddenly followed by an olive-green grass slope, or some white exposure. With this fantastic coloration, to which the brilliant emerald river offers a striking contrast, and over which bends a sky of deepest violet, there is the additional interest of great height and breadth of prospect, and a constantly changing grotesqueness of form caused by the wearing down of rocks of unequal hardness, by water and wind, into towers, monuments, goblins and griffins.

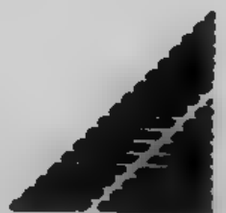
Five miles beyond Drynoch, Nicomen (alt. 25) a little mining town, is seen, and, on the opposite bank of the river, gold was first discovered in British Columbia in 1857. The mountains now draw together again, and the railway winds along their face hundreds of feet above the struggling river. This is the Thompson Canyon. The gorge rapidly narrows and deepens, and the scenery becomes wild beyond description. The frowning cliffs opposite are mottled and streaked in many striking colours, and now and then, through breaks in the high escarpment, snowy peaks are seen glistening above the clouds. At Lytton, a small trading town, the canyon suddenly widens to admit the Fraser, the chief river of the province, which comes down from the north between two great lines of mountain peaks, and whose turbid flood soon absorbs the bright green waters of the Thompson.

The railway now enters the canyon of the united rivers, and the scene becomes even wilder than before. Six miles below Lytton the train crosses the Fraser by a steel cantilever bridge, high above the water, plunges into a tunnel and shortly emerges at Cisco. The line now follows the right-hand side of the canyon, with the river surging and swirling far below. The old Government road, built in the early sixties and abandoned since the opening of the railway, attracts attention all along the Fraser and Thompson valleys. Usually twisting and turning about the cliffs, it sometimes ventures down to the river's side, whence it is quickly driven by an angry turn of the waters. Six miles below Karaka, where it follows the

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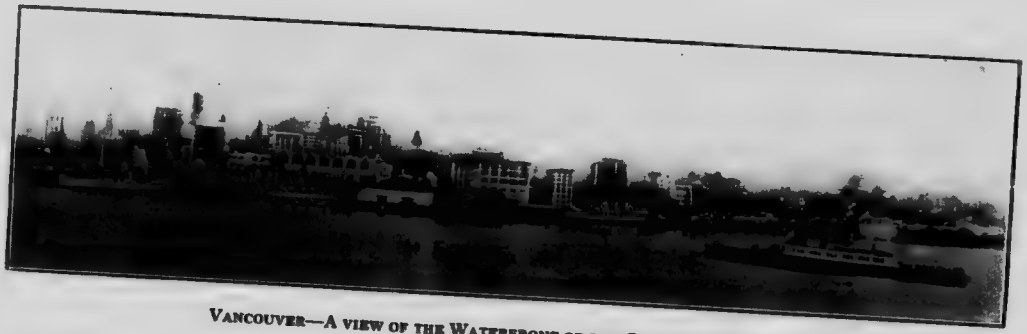
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VANCOUVER—A VIEW OF THE WATERFRONT OF THE GREAT PACIFIC PORT.



GREAT TREES IN STANLEY PARK, VANCOUVER

cliffs, opposite to the railway, it is forced to the height of a thousand feet above the river, and is pinned by seemingly slender sticks to the face of a gigantic precipice. The canyon alternately widens and narrows. Indians are at times seen on projecting rocks down at the water's edge, spearing salmon or scooping them out with dip-nets, and in sunny spots the salmon are drying on poles. Chinamen are noticed on the occasional sand or gravel bars washing for gold; and irregular Indian farms or villages alternate with the groups of huts of the Chinese.

North Bend is a desirable and delightful stopping-place for tourists who wish to see more of the Fraser Canyon than is possible from the trains. At Boston Bar, a few miles below, where mining operations are carried on, the principal canyon of the Fraser commences, and from here to Yale, 23 miles, the scenery is not only intensely interesting, but startling. The great river is forced between vertical walls of black rocks, where, repeatedly thrown back upon itself by opposing cliffs, or broken by ponderous masses of fallen rock, it madly foams and roars. Ten miles below North Bend is Hell Gate, near which a projecting narrow rock is called Lady Dufferin's Walk. The railway is cut into cliffs 200 feet or more above and the jutting spurs of rock are pierced by tunnels in close succession. Ten miles below Spuzzum the enormous cliffs apparently shut together and seem to bar the way. The river makes an abrupt turn to the left and the railway, turning to the right, disappears into a long tunnel, emerging into daylight and rejoining the river at Yale. Yale is the head of navigation and was formerly an outfitting point for miners and ranchmen northward. It occupies a bench above the river in a deep *cul de sac* in the mountains, which arise abruptly and to a great height on all sides.

Ruby Creek is named from the garnets found in the vicinity. At Agassiz, overlooked by Mount Cheam, is a Government experimental farm where fruit and grain are grown in great variety. Agassiz is the station for Harrison Springs (hot sulphur) on Harrison Lake, five miles north. These springs are famed for their curative properties and are visited by invalids from everywhere on the Pacific Coast. Ruby Creek and Agassiz, Harrison Mills and Nicomen, Mission, Whonnock, Haney and Hammond are traversed on the way and into the Fraser River Valley. At Harrison Mills the Harrison River is just crossed above its confluence with the Fraser, where steamer is taken for the Chilliwack district and a valley comprising 55,000 acres of rich agricultural land.

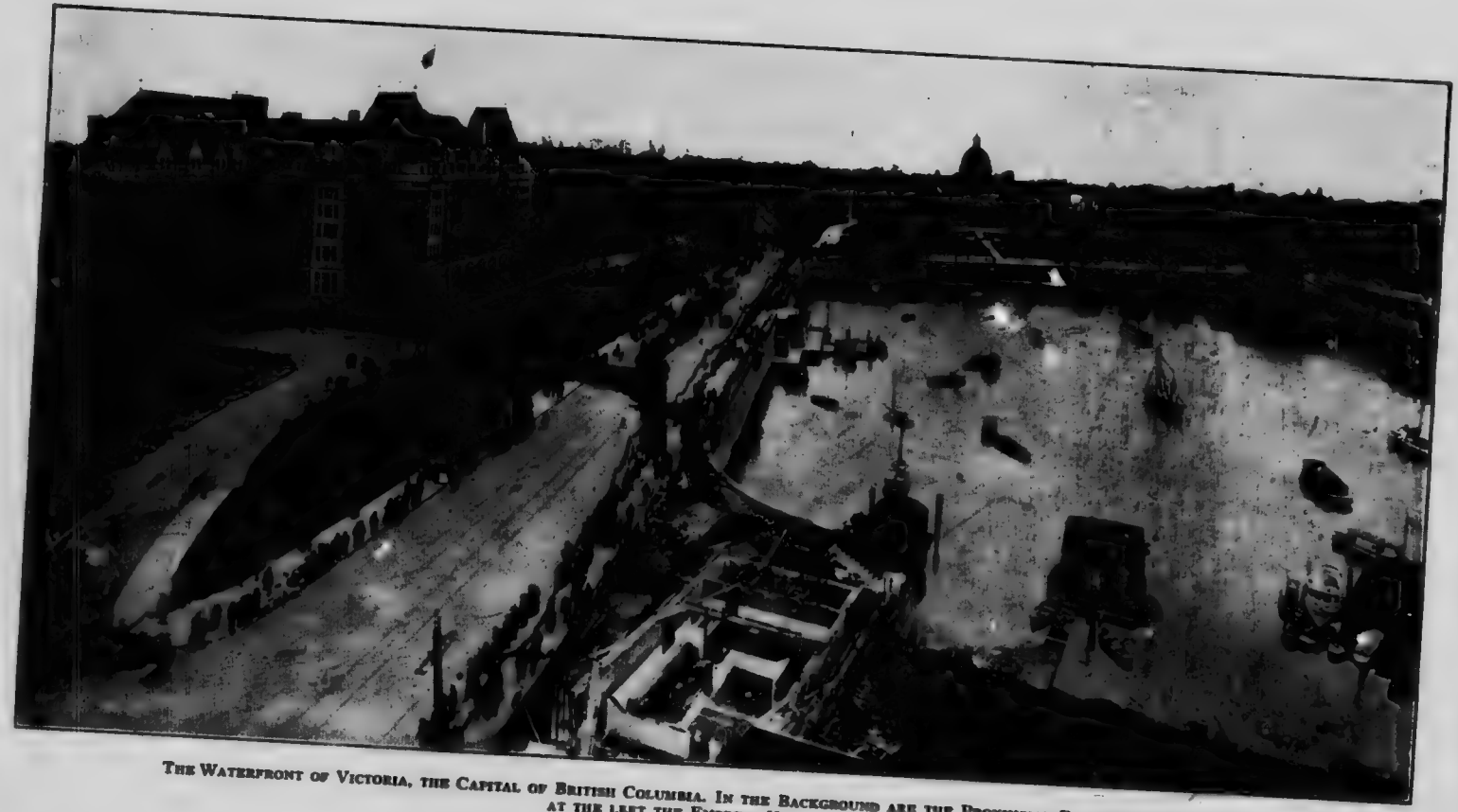
The celebrated Pitt Meadows are traversed, and a couple of miles before reaching Westminster Junction, the Pitt River is crossed. Immense trees are now frequent, and their size is indicated by the enormous stumps near the railway.

Port Moody, at the head of Burrard Inlet, was for a time the terminus of the C.P.R. From here to Vancouver the line follows the south shore of the inlet, and the outlook is most delightful. Snow-tipped mountains, beautiful in form and color rise opposite and are vividly reflected in the mirror-like waters of the deep-set inlet. At intervals along the heavily-wooded shores are mills with villages around them, and with ocean steamships and sailing craft loading sawn timber for all parts of the world; on the other hand, and towering high above, are gigantic trees, 20, 30 and even 40 feet around. Passing Hastings, formerly a watering place, the young city of Vancouver is reached.

Vancouver
Aug. 25-27

When Vancouver was founded and incorporated in 1886 its future site was occupied by dense forests; between May and July clearings were made and houses erected, but in the latter month fire swept away everything except one house. Today it has an estimated population of 200,000 with extensive wharves and warehouses along a portion of its 80 miles of water frontage and 40 miles of anchorage; its churches and missions total 85 in number and it has 17,000 pupils enrolled in the schools with an assessment of $224,202,883; its bank clearings in 1919 were $655,913,205, its manufactured products (1915) $33,871,000 with 435 industries in the city and surrounding district; its parks number 23 of 1,415 acres, with Stanley Park famous for its scenery and its superb trees. Its bathing beaches cannot be surpassed.

Vancouver is situated on Burrard Inlet and is the terminus of the C.P.R, Great Northern, Canadian National Railways, the Pacific Great Eastern and the B.C. Electric Railway; it has mail steamers to Honolulu, Japan, China, Australia and New Zealand with other lines to Prince Rupert, Victoria and Nanaimo, San Francisco, Seattle and other coast points, as well as the Yukon, and from England and Europe, monthly, via Suez and Panama Canals; it is headquarters for the fleet of Canadian Pacific Ocean steamers, the finest vessels on the Pacific with perhaps the shortest, safest and most pleasant route to the Orient—with two recent



THE WATERFRONT OF VICTORIA, THE CAPITAL OF BRITISH COLUMBIA. IN THE BACKGROUND ARE THE PROVINCIAL PARLIAMENT BUILDINGS, AT THE LEFT THE EMPRESS HOTEL

additions to the service in the "Empress of Russia" and "Empress of Asia;" its trade with other countries (March 31, 1919) was $37,373,971 in exports and $46,736,197 in imports; lumber exported by ship in 1918 was 53,400,000 feet B.M.

The shipping of the port (1917) was 22,985 vessels of 10,890,748 tons register. During that year 14 vessels were launched of 37,300 tons, in 1918 46 vessels of 145,000 tons, in 1919, 57 vessels (including 10 steel steamers) with a tonnage of 165,000—a total value for the three years of $61,000,000. A large proportion of the silk trade of the continent passes through the port and the C.P.R. "Silk Train" is famous in trading circles. Industries include lumber and shingle mills, foundries and structural steel works, sugar refining and ship-building and the city is the centre for great salmon, halibut and herring fisheries. Its chie hotels are the Vancouver, a palatial structure of the C.P.R., Glencoe Lodge, St. Francis, Castle Barron, Regent, Alcazar, Dunsmuir, Grosvenor and St. Regis.

Its suburbs include North Vancouver (10,000 population) with 12 churches and 10 schools, eight parks and five banks, five lumber mills and large ship-building industries; South Vancouver with 40,000 people, 15 churches, 10 schools and three hospitals, saw mills, toy and box factories, foundries and furniture factory, etc.; Point Grey with 15,000 population and the site of the University of British Columbia founded in 1907 with 38 teachers and 400 students. South of the city towards the Fraser, the country has fine farms, and is adapted to fruit growing. The railway, running from Vancouver to Steveston, intersects this district and gives access to the salmon canneries at the mouth of the Fraser River. The coal supply comes from Nanaimo, directly across the Strait of Georgia, and almost within sight.

The scenery all about is magnificent—the Cascade Mountains, near at hand, at the north; the mountains of Vancouver Island across the water at the west; the Olympics at the southwest; and Mount Baker looming up at the southeast. Opportunities for sport are unlimited at no great distance—mountain goats, bear and deer in the hills along the Inlet; trout-fishing in endless variety; while Capilano Canyon a few miles across the Narrows, affords a pleasant outing. C.P.R. and G.T.P. steamships connect Vancouver with Victoria, Seattle, Prince Rupert and Alaskan coast points. Their steamships are said to be the fleetest boats on the Pacific Coast Service, and are known among steamship men as being the first Canadian boats to adopt oil for fuel purposes.

Victoria
Aug. 27-29

Across the Strait of Georgia on the southern end of Vancouver Island is Victoria, the capital of the Province and terminus of the Esquimalt and Nanaimo and Victoria and Sidney Railways, and located, also, on the Canadian Northern Pacific. It is the centre of commercial life and progress on Vancouver Island which is 300 miles long and 85 wide and has been called "The Island of a thousand miles of Wonderland;" it possesses automobile roads of uniquely picturesque character, every kind of game and fish, an area of 10,000,000 acres, much of it unexplored but known to be rich in agricultural, fishing, mining and timber resources.

Victoria is veritable City of Sunshine with a bright, mild, healthy climate, a death rate of 7.86 per 1,000 and an average rainfall of 27.01 inches. It has wharves with 30 feet of water at low tide, C.P.R. steamers operate from here to Vancouver and Seattle and G.T.P. steamers between this city and Seattle, Vancouver and Prince Rupert; various steamers run to points on Puget Sound and on to Alaska and intermediate points while Pacific and Oriental steamers stop here; it has an electric railway to Esquimalt (five miles) with its naval yards and fortifications, dry-dock and fine harbour and to Oak Bay, four miles away; its chief hotels are the Empress (C.P.R.), Dominion, Dallas, Westholme, King Edward, Strathcona.

It is the seat of the Parliament Buildings which are picturesque in design and situation; it has many churches and schools with 13 chartered banks and is the seat of a Dominion Astro-Physical Observatory; it has Dominion Government breakwater and docks at Ogden Point, public gardens and artificial ice rink; its population is estimated at 60,000 and it was founded in 1843 by Governor Sir James Douglas. The external trade of Victoria (March 31, 1919) was $4,929,327 of exports and $9,046,030 of imports; its bank clearings in 1919 were $119,391,345 and assessment over $110,000,000; it has a great 72-inch reflecting telescope said to be the second largest in the world; its industries number about 150 which include paint, tile-works, tents, canneries, shipbuilding, soap, lumber, machinery, furniture, carriage, brass, boats, and biscuits.

Beacon Hill Park affords a fine view of the waters and the mountains on every

VICTORIA, THE CAPITAL OF BRITISH COLUMBIA. IN THE BACKGROUND ARE THE PROVINCIAL PARLIAMENT BUILDINGS, AT THE LEFT THE EMPRESS HOTEL



MOUNT ROBSON AND ROBSON GLACIER.
THIS MOUNTAIN (13,068 FT.) IS THE HIGHEST PEAK IN THE CANADIAN ROCKIES
An excellent view of this Monarch of the Rockies is had from the Transcontinental Line of the Canadian National—Grand Trunk Railways.

side. The city has many large commercial houses which have done a great outfitting trade for the Yukon. The Chinese quarter is always interesting to visitors. The Esquimalt & Nanaimo Railway extends north-easterly 139 miles to the great coal mines at Nanaimo and to Port Alberni, the nearest Canadian port to the Orient with Transcontinental connection and Courtenay, passing through a fruit-growing and farming as well as very pretty country in which are several pleasant summer resorts with excellent shooting and fishing obtainable. A large number of English people have settled in the neighborhood of Duncan's where the delighted climate and fertile soil are such as to combine pleasure with profit. The C.N.R. is building a line from Victoria to Cowichin Lake which will open up a rich timber tract.

Eastward Again Aug. 30

Returning to Vancouver the journey eastward commences on the Canadian National Railways, formerly the Canadian Northern, giving new views of the mountains, new impressions of solemnity and splendour, new forms of sport and enjoyment, new visions of the power of nature in its greater physical manifestation. Passing from Vancouver the trains reach New Westminster, on the Fraser River. It is the headquarters of the salmon canning industry, which is represented by a dozen or more extensive establishments. It has, also, large sawmills (the product of which is shipped largely to China, South America, Africa, Europe and Australia), and the Provincial asylum and penitentiary are located here. the city is also a centre for the Great Northern Railway, C.N.R. and the B.C. Electric Railway running 12 miles to Vancouver and 64 miles to Chilliwack.

It has a splendid harbour of fresh water and excellent wharf sites with Government works under way at the mouth of the Fraser costing $2,000,000; it is the seat of an Anglican and a Catholic Cathedral with 19 other churches and of Columbian college; it has the usual free public library, owns its utilities and has five banks, two hospitals, an armoury and orphanage, government buildings, three theatres and several parks. New Westminster is the centre of lumbering industries and a fruit-growing region and dairying developments, Fraser River canneries and minig with six lumber mills; it has many other industries, including ship-building, four nurseries, bricks, monuments, evaporating vegetable plant, cold storage, cigars, tanneries, meat-packing and aerated water, boat building, iron works, machine shops, sash and door factories, shingle mills, gasoline engines, cordage and engineering.

Leaving Port Mann, a succession of villages is reached which span the richest part of the Fraser River Valley and include Port Kells, Langley, Glen Valley, Mt. Lebanon, Matsqui, Sumas, Arnold, Chilliwack, Rosedale, Cheam, Riley, Laidlaw, St. Elmo and Floods. The altitude rises steadily at these stations from 24 to 117; the village of Hope is next and stands upon the site of Fort Hope—of Hudson's Bay Co. fame—from here there pass many trails through the mountains, a fine motor road to several fishing waters, succeeding points are Trafalgar and Yale (alt. 154 feet), where miners and ranchmen obtain their outfits and which, like Hope, was a Hudson's Bay post and founded about the same time in 1848. From here through Chapman Bar and Boston Bar, Boothroyd and Inkitsaph, Falls Creek, Cisco and Lytton, the railway continues through the Fraser River Valley to Lytton (alt. 566 ft.).

The line runs most of this distance on the south side of the Fraser River, punctuating the headlands with tunnels and spanning ravines by bridges; it traverses the famous Great Gorge which begins at Yale and shows the River, when forced back upon itself by huge rocky projections, swirling from one side of a great chasm to the other and roaring in tempestuous fury in its effort to overpower huge boulders and jagged masses of displaced rocks; it passes between the Cascade Range on the east and the Coast Range on the west as the huge mountains hem in the river and the railway; at Lytton the Thompson meets the Fraser and the line crosses the former by a bridge—in the distance may be seen great glaciers and ice fields.

Gossett, where may be seen the Gladwin Bluffs—cliffs of most brilliant colour including russet and grey, variegated yellows and black and brown—Seddell and Skoouka are succeeding stations and then comes Spence's Bridge (alt 738 ft.), which is picturesquely situated in the valley at the base of Arthur's Seat Mountain rising abruptly to an altitude of 5,800 feet. At the base of the mountain may be seen silt escarpments from which a huge slide occurred on Aug. 13th, 1905, damaging the Thompson River and causing the destruction of an Indian village

THIS MOUNTAIN (13,068 FT.) IS THE HIGHEST PEAK IN THE CANADIAN ROCKIES
As excellent view of this Monarch of the Rockies is had from the Transcontinental Line of the Canadian National—Grand Trunk Railways.



THIS BEAUTIFUL PEAK IN JASPER NATIONAL PARK, ALBERTA, HAS BEEN NAME MOUNT EDITH CAVELL

on the far bank. The old waggon road to the Caribou gold fields runs from this place and brings back memories of the stream of miners and adventurers who took part in the wild rush of 1857; the town, itself, is a distributing point for great modern mining and ranching regions in the hills.

The country here is very dry but with irrigation produces marvellous crops and to the south is the fertile and famous Nicola Valley. Between the stations of Minnabarriet and Basque there may be seen gypsum and china clay in crumbling outcrops of red, yellow and white, contrasting in vivid forms with the green foliage of trees above and the swirling, changing waters below. Ashcroft, on the Thompson River, and also on the C.P.R., is the distributing centre for the Caribou and Omenica goldfields and around it are historic memories and traditions of the golden days of the Sixties when as high as $600 a pan was recorded. Pack horses and trains of freight waggons drawn by long strings of mules can be seen leaving for the mining districts almost every day. Around it is also a ranchers' country and three miles below the village—which has about 500 population—is the Black Canyon where the Thompson River has cut through the shale and sandstone for a depth of 200 feet to its present bed. At Basque there are enormous deposits of Epsom Salts, said to be the largest known, which are being worked by an eastern chemical company.

Anglesey, Walhachin, Savona (alt. 1,171 ft.), Copper Creek (alt. 1,159 ft.) and Tranquille (alt. 1,180 ft.) succeed each other as stations through the rugged series of canyons pertaining to the Thompson River and an enlargement known as Kamloops Lake. The town known by this name is next reached.

Kamloops
Aug. 30

Kamloops (alt. 1,150 ft.) is the chief town of the valley and was originally a Hudson's Bay post; it is situated in beautiful surroundings with abundant game, birds and fish for the sportsman, a background of hills and groves for the sightseer and steamboats on the river and sawmills on the banks for the business man. It has various schools and churches, a convent, hospital, old men's home, five banks and a large park; its chief industries are cold storage and bottling plants, cigars, sashes and doors, machine shop and foundry. The principal industries around Kamloops are cattle and horse raising and fruit-growing under irrigation. The latter is progressing very rapidly as this district is well adapted for all kinds of fruit-culture. It is the supply point for a large ranching and mineral region southward, especially in the Nicola valleys and for the valley of the North Thompson, a rapidly developing district rich in timber, mineral and agricultural wealth.

The valley of which Kamloops is the centre has beautiful scenery, the climate is healthy and invigorating, fruit growing is carried on by irrigation and many horses and cattle are raised. Succeeding points are Kamloops Junction and Louis Creek (alt. 1,229 ft.), a region where general agriculture and fruit growing are being conducted on a large scale; Chinook Cove, Chu-China and Clearwater—at the junction of Clearwater River with the Thompson; Wire-Caché, Stillwater, and Blue River where a divisional railway point is established and some fine scenery exists; Clemina, where the Albreda River flows into the North Thompson and which was celebrated in construction days as "mile 49;" Albreda station follows and Canoe River (alt. 2,721 ft.).

Of the Canoe River Valley running between these latter places A. W. Johnson a government land surveyor, has stated that: "In a country where scenery is a drug on the market, it may seem foolish to say anything about it, but I know of no grander views than may be obtained in the Valley of the Canoe throughout its entire length. It rises in stupendous glaciers among the Mica Mountains, winds like a tortured snake across the wide flats at Cranberry Lake, and then flows for 70 miles between enormous rocky peaks and glaciers that are quite as fine as anything at Rogers Pass or Field. The Albreda Valley is almost as grand, and the Canadian National offers an unsurpassed route. To the sportman the district offers everything from grizzly bear to willow-grouse. It is pre-eminently a caribou country. While there are plenty of goat, sheep occur only on the main range of the Rockies east of the Canoe. Black bear are fairly common."

Swift Creek and Jackman have great heights of the Mica Range in sight and after Morey, the traveller and his train enter the wonderful region, ending at Robson Station, where the Grand Forks enters the Fraser River and the precipitous base of Mount Robson is but 4½ miles away. It is the highest and perhaps the most majestic peak of the Canadian Rockies rising to an altitude of 13,068 feet. At the head of the low valley marked by Robson, its tremendous cliffs, too steep for snow to lie, rise majestically, cliff on cliff, for over 7,000 feet above Berg Lake,

This Beautiful Peak in Jasper National Park, Alberta, has been named Mount Edith Cavell



PUNCH BOWL FALLS,
JASPER NATIONAL PARK.



THE MAGNIFICENT TOTEM POLE WHICH STANDS GUARD OVER THE HEADQUARTERS BUILDING OF J. PER PARK

to its summit, where the vapours of the Pacific gather nearly every day in the year. Here are formed the Mist Glacier, and the Tumbling Glacier, which latter extends two miles in horizontal distance, and has 7,000 feet vertical descent between the snow cornices of the mountain and its foot at Berg Lake.

As the railway passes on through Resplendent and Rainbow, Cranbrook and Lucerne, to Yellowhead Summit and Cavell (alt. 3,631 ft.), there is a succession of splendid scenes. Mount Robson remains in sight and towers over the traveller for three miles with other snow-clad peaks to take its place; Moose Lake, Rainbow Falls and Rainbow Canyon are passed in turn and at Lucerne there is a magnificent view of Mount Fitzwilliam, which rises to an altitude of 9,600 feet. Back of Lucerne, an old Indian trail leads round the base of Mount Fitzwilliam, through a pass, into the mountains beyond. This is a virgin country and of wonderful interest to Alpine climbers, as there are several ice-fields and numbers of mountains to the south that are unnamed and unclimbed. From the lookout at an elevation of 6,000 feet, large ice fields can be seen while 30 snow-capped mountains may be counted, and a number of beautiful glaciers.

Jasper
Aug. 31

At Cavell the summit or great continental divide which serves as a boundary between Alberta and British Columbia is reached and in the distance is Mount Edith Cavell, so christened in honour of the heroic British War nurse, and over 11,000 feet high; here the railway enters the famous Yellowhead Pass and follows Miette River for 12 miles between lofty ranges looming up on either side; here, also, is the town of Jasper situated on a plateau at the base of the Pyramid Mountain (alt. 9,026 ft.), close to the entrance of the Pass and at the confluence of the Miette and Athabasca Rivers. It is the headquarters of Jasper Park (alt. 3,456 ft.), a great game preserve and Government reservation of 4,000 miles. Through this Pass and the heart of the scenery in this wonderful park there also runs the Grand Trunk Pacific line from Edmonton to Prince Rupert, B.C.

Yellowhead Pass widens out, then narrows again as it curves through the mountains. On each side it is flanked with mighty peaks, and the traveller sees the full contour and majesty of the mountains. It was for generations the great natural artery of the fur trade, a centre of the activities of the Hudson's Bay and other companies and was called after a yellow-headed hunter of a century ago called Jasper Hayes. Here are majestic peaks, snow-capped and glacier-scored, ragged, forest-clad slopes, flower-strewn passes, impressive solitudes, beautiful lakes, vast snowfields, great glaciers, and the headwaters of mighty rivers. All these and myriads of other attractions to be found in the Canadian Rockies make an asset beyond estimate. Continuing through the Park or the Pass, the mountains rise, arrayed one above the other, and appear to form an impenetrable barrier against which further progress is impossible, but out from among the mountains flow the hurrying waters of a river that points the way to where nature has cleft the range and opened a pass through which the interchange of commerce between the plains and the Pacific Ocean may proceed. The Pass, as a whole, includes 14 great mountains of between 10,000 and 11,000 feet, besides Mt. Robson and 30 others of from 7,000 to 9,700 feet.

One of the scenes at this point on the route is Maligne Lake to which a trail has been built; this body of water is one of the most beautiful in the whole vast range of the Rockies and is surrounded by mountains which rise from the sandy beaches at the water's edge. The effect of the snow-capped peaks, with their brown shale exposures splashed with crimson stains, the glaciers and the dark verdure of the foothills reflected in the water, form a picture of amazing beauty. The traveller may return from the lake by way of Shovel Pass, which takes him up to an altitude of near' · 8,000 feet and affords one of the finest views in the mountains. Ice fields, a hundred snow-capped mountains, most of them unnamed, may be seen from an elevation a few feet above the Pass. Mount Tekarra also forms a part of the Maligne Range. Near Jasper the Maligne River runs into the Athabaska; before doing so it runs for many miles in subterranean passages and then re-appears in a canyon of most spectacular character with great gorges and chasms and beautiful cascades visible from the railway bridge which crosses it.

After passing Jasper, the station Henry House (alt. 3,348 ft.) is reached. It commemorates an historic old post of the Nor' Westers, dating from about 1811; Snaring and Devona and Bedson and Brule are succeeding stations with the Athabasca River in constant sight; regions of the Park around, filled with mountain goat and sheep and the finest sport for the hunter and an 800-foot tunnel passing under the slope of the 8,000 feet Boulé Roche Mountain; a region

THE MAGNIFICENT TOTEM POLE WHICH STANDS GUARD OVER THE HEADQUARTERS BUILDING OF J. PER PARK

PUNCH BOWL FALLS, JASPER NATIONAL PARK.



EDMONTON, THE CAPITAL OF ALBERTA, SHOWING THE PARLIAMENT BUILDINGS IN THE CENTRE

around Brule estimated by the Department of Mines to contain 600,000 tons of coal follow in rapid succession. Errington, Solomon and Entrance follow; the train and the traveller to the foothills and the prairies. The Entrance station (alt. 3,216 ft.) is a gateway to the mountains or the prairies as the case may be, and the railway then rushes into and through lower areas of land, and the great ranching regions of Alberta. Twenty-five villages or stations are passed including Edson and Lac Ste. Anne—a popular summer resort,—Villeneuve, where there is an Indian reserve, St. Albert (alt. 2,172 ft.) and then Edmonton (alt. 2,185 ft.) is reached.

Edmonton Sept. 1

The capital of Alberta has a splendid location on the high banks of the Saskatchewan River, 793 miles west of Winnipeg and 946 miles east of Prince Rupert; it is the headquarters in the province for three transcontinental lines—the C.P.R., C.N.R. and Grand Trunk Pacific with seven branches, of the Edmonton, Dunvegan and B.C. Railway to the rich Peace River country and the Alberta and Great Waterways line to Fort McMurray on the Lower Athabasca; it has a population of about 65,000 and is the seat of Government House, the Parliament buildings, 40 churches, Roman Catholic convent and seminary, 20 banks and 33 public schools; it possesses the University of Alberta which was founded in 1906 and has 42 teachers and over 400 students together with its affiliated Alberta and Robertson Colleges; it is the most important Dominion land agency in Western Canada and a large and increasing local market and centre for a rich agricultural district with 90 wholesale houses; it is the supply base for the growing settlement and production of the great Northern Peace River region; it has municipally-controlled electric light and power, water, telephones and street railway.

Edmonton, literally sits on coal and has over 30 coal mines in or about the city with indications of natural gas and oil in tributary territory and timber and stone within easy distance; its industries are growing and include three meat-packing houses, brickyards, sawmills and flour mills, oatmeal, several creameries, elevators, cigars, aerated water and clothing, foundries, boxes, biscuits, brass, mattresses, sashes and doors, sheet metal, motor boats and wire fences; its assessment in 1918 was $92,484,565, its bank clearings in 1919 were $233,066,580, its imports were $4,535,245. Its principal hotel is the Macdonald owned and operated by the Grand Trunk Pacific Ry.

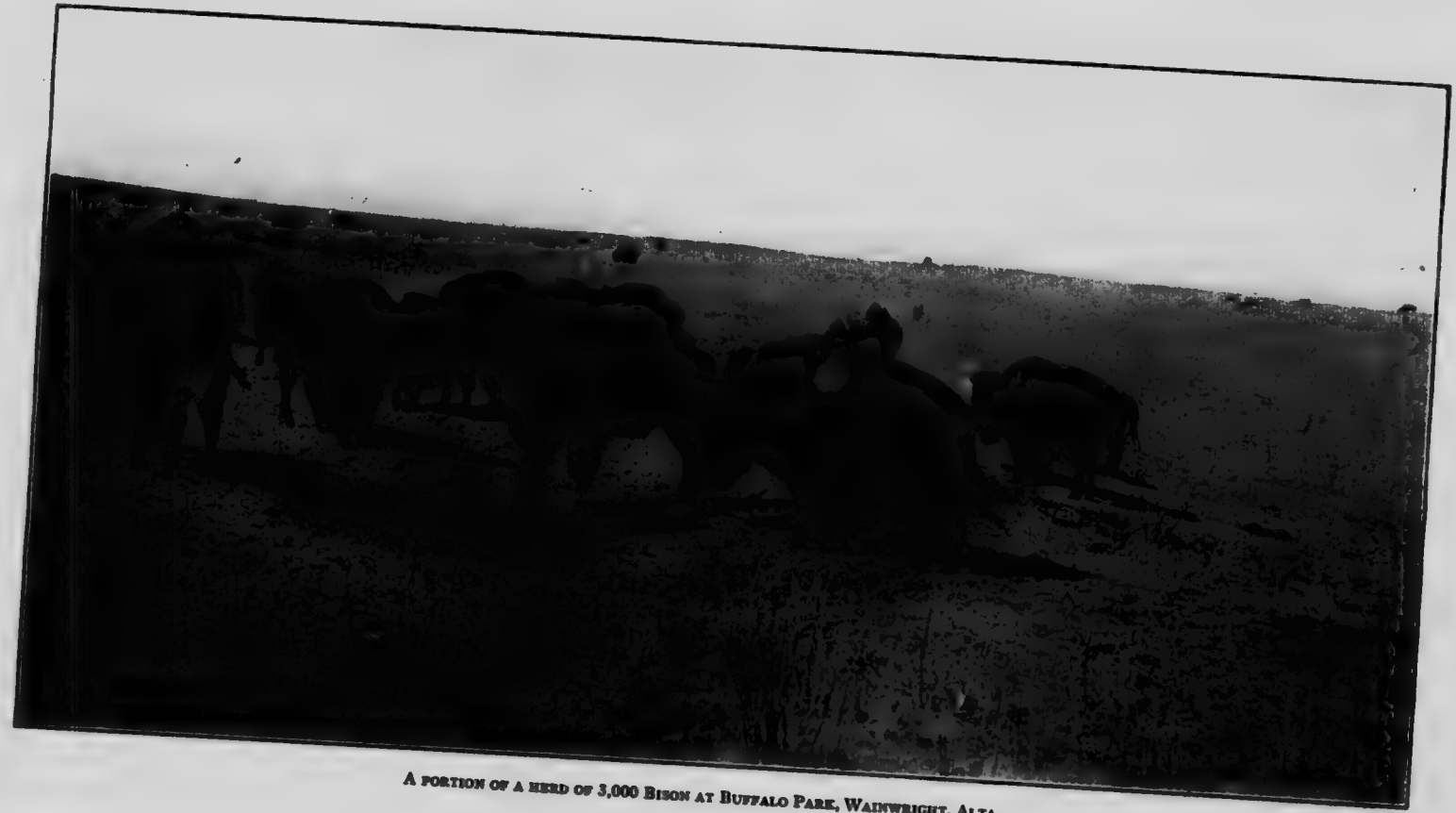
The train leaves Edmonton by the Grand Trunk Pacific, head towards the great grain-producing sections of the Prairie Provinces, and pass through a rich mineral section of the Province of Alberta where, at Tofield, the passengers may see coal being taken from the surface and carted in wagons to the consumer. The route is through a wonderful country, with magnificent plains and beautiful valleys.

Wainwright Sept. 2

At Wainwright, situated about three miles from the Grand Trunk Pacific station, is the Buffalo Park. This is the highest fenced park in the world and contains the biggest herd of buffalo in existence. The herd in 1909 was composed of only 685 animals, and has increased until at the present time there are approximately 3,700 of these monarchs of the plain. Visions arise in the minds of the onlookers of the days in the long-ago when pioneers followed their immense herds and killed them for the supply of meat. The history of the buffalo in the West is interesting. In 1897 the Dominion Government received the gift of a few bison from T. G. Blackstock, Toronto, which were placed in Banff Park. The next year the number was increased by the presentation of thirteen by Lord Strathcona from his herd at Winnipeg.

The first real step in the acquiring of the herd now in the park here, was made in 1906. Michael Pablo, of Montana, had for years a considerable herd, enclosed in a natural depression in the valley in the mountains of that state. He was compelled to get rid of his animals as the Government were going to throw open the land for homesteading. Mr. Pablo entered into negotiations with the U.S. Government with the view of making them a national asset. Col. Roosevelt and the American Bison Society were trying to get the U.S. to purchase the herd.

While Congress were debating the matter, Mr. Ale Ayotte, Canadian immigration agent at Missoula, got in touch with his chief and before Congress awoke to the fact the Canadian Government had contracted for the lot at $300.00 per head. At the time of sale it was estimated there were 300 bison in the enclosure, but at the round-up it was found that there was a total of 706. The lot was then



A portion of a herd of 3,000 Bison at Buffalo Park, Wainwright, Alta.

taken at $250 per head, f.o.b. Edmonton. It took nine days to load 200 on the train with the loss of eight who were killed in their struggles against being placed in cars.

The area of the park is 160 square miles or approximately 100,000 acres. It is fenced with woven wire seven feet in height, and cross fenced, and fire guards are ploughed around the whole fence.

Much interest has been taken by cattle men in the experiments being conducted at the Buffalo Park, in trying to produce a new breed of cattle from crossing with the buffalo. The cattalo was first produced by a man in Ontario who had several buffalo on an island farm, where he was successful in raising the first cattalo. He endeavoured to get the Government interested, but at the time nothing was done. His death caused operations to cease, and his sons again took up the question of disposing of the cattalo to the Government. The deal was finally consummated and the cattalo were first removed to the demonstration farm at Scott, Saskatchewan, and later transferred to the park here.

The cattalo are not the product of a cross between a buffalo and domestic cow. In originating the species, a domestic cow was bred to a buffalo bull, and a buffalo cow bred to a domestic bull. The progeny from these two matings were then mated and the cattalo was the result.

The country between Wainwright and Biggar is well suited for mixed farming, and the dairying and live-stock interests of the Wainwright district particularly have been very highly developed. Wainwright neighbourhood is particularly adapted to sheep-raising, and great flocks are now in the locality. It is estimated by competent judges that there is an average of forty cattle per head owned by every farmer in the country tributary to Wainwright. This is indeed a very satisfactory live-stock condition. In the old days, Wainwright was essentially a ranching country, with many sloughs and little lakes, and today cattle-raising remains one of the chief industries.

An excellent farming district is traversed and the city of Saskatoon is reached during the night. The trains are transferred from the Grand Trunk Pacific to the Canadian National Railway line and proceed to Prince Albert.

How excellent is the farming territory on the Grand Trunk Pacific line in Saskatchewan and Manitoba is evidenced by the fact that Mr. Paul Kerlach, a farmer of Allan, Sask., on the main line of the G. T. P., carried off, at the International Dry Farming Congress held recently at Tulsa, Okla., the first honours in a competition open to all the world with Marquis wheat, weighing seventy-one pounds and one ounce to the stricken bushel, which constitutes a world's record.

A PORTION OF A HERD OF 3,000 BISON AT BUFFALO PARK, WAINWRIGHT, ALTA.

Prince Albert
Sept. 3

Prince Albert, which was named after the consort of the late Queen Victoria, is situated on the banks of the Saskatchewan River, and is claimed to be the centre of the Province of Saskatchewan. The city itself is beautifully situated and is probably one of the prettiest cities in Western Canada. The natural beauty of the town has been preserved and enhanced by planting trees and making boulevards wherever possible. The population is about 10,000, but the city is the centre for all purposes of a district of some two hundred miles by one hundred miles and containing some of the best mixed farming country in Canada.

Prince Albert is also the judicial headquarters, the land district headquarters, the headquarters of the Anglican Diocese of Saskatchewan and the Roman Catholic Diocese of Prince Albert. It is also one of the divisional headquarters of the Royal North West Mounted Police. Five lines of railroad are operated from the city and two more branch lines are under construction. The Government has erected co-operative stockyards in the city.

A total crop failure is unknown in the Prince Albert district. Luxuriant grasses grow all over the country, while the poplar bluffs and sloughs provide ample feed shelter and water for the stock.

Prince Albert was founded in 1876 by the Rev. James Nesbitt, a Presbyterian missionary. It first became a trading centre, then a headquarters of the great Hudson's Bay Company, and eventually by its lumbering, farming and stock-raising enterprises, become the progressive and prosperous city that it is today.

The district traversed by the Canadian National Railways between Prince Albert and Saskatoon was the scene of many stirring episodes of frontier life in the days of the fur trade, and was also the chief theatre of the half-breed and Indian uprising in 1885. Fort Carlton a few miles southwest of Prince Albert was for many years the principal interior post of the Hudson's Bay Company, being convenient to the great plains for trade with the wild buffalo hunters and also to the

lake and forest districts to the north which yielded an abundance of food supplies, such as fish, and furred and feathered game, and a remarkable variety of luscious wild fruits. Duck Lake, on the line of railway south of Prince Albert, was the scene of the first sanguinary conflict between a small force of Mounted Police and a company of volunteers and the half-breeds and Indians in 1885. At Fish Creek and Batoche, in the neighborhood, the natives fought hopeless engagements with the Canadian troops from the East.

Saskatoon
Sept. 3

Saskatoon is built on the banks of the South Saskatchewan river, in the Province of Saskatchewan. It is the educational, commercial, financial, distributing centre of middle and northern part of the province, aside from being surrounded by unsurpassed agricultural territory. Saskatoon has experienced a most phenomenal growth. In 1899 it consisted of but a few houses or shacks. In 1901 it was incorporated as a village; in 1903 as a town, and in 1906 as a city of approximately 5,000 inhabitants. Today its population is estimated at 30,000.

Saskatoon is noted as an educational centre. It is the seat of the University of Saskatchewan and Agricultural College, besides a collegiate institute, normal school and thirteen public schools. The large farm attached to the College of Agriculture is well equipped with live-stock. Its function is to augment the teaching of the college by the field demonstrations. In addition, agricultural experts carry on a scheme of extension work throughout the province. Excursions of farmers to the college are often organized and during the summer months a train made up of exhibits, and manned by teachers, carries its educational message to farmers in all parts of the province. New features of the extension department are the home-makers' club for the training of farm women, and a boys' work section which brings the younger farm boys into close touch with the university. Vocational training is also provided for returned soldiers, principally in farm engineering and carpentry.

The city as a distributing centre is represented by over fifty wholesale houses and cold storage plants. The three great railways of Western Canada, the Grand Trunk Pacific, the Canadian Pacific and Canadian National Railways enter the city and radiate in every direction, making Saskatoon an important railway centre. A Dominion Government interior terminal elevator, with capacity of 3,500,000 bushels, and two flour mills, with capacity of 2,250 barrels daily, are located within the city limits.

En route from Saskatoon to Winnipeg, the G. T. Pacific traverses one of the best farming districts in Western Canada, 255 miles of which is within the Province of Saskatchewan. The province is noted as a wheat-growing area and is said to produce more wheat than the other prairie provinces combined. The value of Saskatchewan's cereal crop in 1918 was $310,577,000.00, and the average yield per acre for the last ten years is 17½ bushels, although for 1915 Dominion Government figures give the average as 28.54 bushels. The live-stock industry is developing rapidly, generally throughout the province.

The most important towns passed through en route to Winnipeg are Watrous, Melville, Rivers and Portage la Prairie. These towns, with the exception of the latter, have sprung up since the opening of the Grand Trunk Pacific Railway, and give promise of much greater development as the surrounding country fills up.

Watrous, 64 miles east of Saskatoon, is noted principally because of Little Lake Manitou. This wonderful lake, 14 miles long and one and one-half miles wide, located two and one-half miles from the town, is one of the most remarkable mineral water lakes in the world, and many physicians pronounce that the waters of this lake contain greater curative properties than any other known lake or mineral spring in the world. Bathing in its water is wonderfully beneficial and so buoyant that bathers may readily float without the least effort. A comparative analysis of Little Lake Manitou and the famous Carlsbad of Germany, shows a greater proportion of ingredients in favor of "Manitou" and richer in total saline constituents—a lake six times more buoyant than the ocean.

Melville, Sask., is an important divisional point on the Grand Trunk Pacific Railway with a population of 3,500. Here branch lines of The Grand Trunk Pacific diverge south to Regina, the capital, of the province, Moose Jaw, Weyburn, etc., and north to Yorkton and Canora.

Winnipeg Revisited Sept. 4

The town of Rivers, population 1,200, is located in the province of Manitoba. It is situated in a prosperous farming district and is a divisional point of the Grand Trunk Pacific. Hence the trains proceed to Portage la Prairie, visited on the way west and 54 miles further on is Winnipeg to be briefly revisited. Leaving Winnipeg by Canadian National Railways the trains leave the prairie at Anola and after passing Elma and Dott, the boundary line between Manitoba and Ontario is crossed east of White Station.

New Ontario: A Wilderness Of The Past, A Great Country of the Present and Future

Into Northern Ontario the tourist comes from the mountains and the prairies or the fields of the older provinces as to a new land—rougher, perhaps, and more unsettled, much more rugged and uncultivated; but, as a whole, rich in most of the things which nature provides for a great country. It includes the Districts of Temiskaming, Algoma, Thunder Bay and Kenora, Patricia, stretching up toward Hudson Bay, Nipissing, Sudbury and Rainy River, with an area of 330,000 square miles—a region far larger than Great Britain, France or Germany. It has vast resources in timber which include large areas of spruce and balsam, as the basis of a great pulp and paper industry, with 300 million cords along the line of the T. and N.O. Railway alone; its minerals include the copper and nickel of Sudbury, the gold of the Porcupine, the silver of Cobalt, the iron ore of several sections; its water powers are varied and widely dispersed in navigable lakes and rivers; its fish and game are innumerable and to be found everywhere, and its scenery is a constantly-changing panorama of interesting variety; its climate, extending over a territory which runs 800 miles north and south, is varied but, in general terms, is warm in summer and cold and bracing in winter; its agricultural resources are many, from the small but fertile valleys of Algoma to the Great Clay Belt, comprising an area of at least 24,000 square miles, or 15,680,000 acres. This almost unbroken stretch of good farming land is nearly three-quarters as great in extent as the whole settled portion of the province south of Georgian Bay, Lake Nipissing and the French and Mattawa rivers.

Mining is the chief industry of that part of Northern Ontario served by the Temiskaming and Northern Ontario Railway. From the silver and gold mines which have been developed during the past sixteen years, a total of $240,911,729.85 has been produced in new wealth. Nor does this appear to comprise more than the result of having developed what mining geologists declare to be only the southern fringe of the Canadian pre-Cambrian Shield.

The silver production from this district up to the end of 1919 having amounted to 303,610,836 ounces valued at $182,039,972, and the gold output which only commenced in 1910 having reached $58,871,757 at the end of 1919, marks a commencement which compares favorably with the world's most important precious metal mining areas.

Beginning at North Bay and extending to the northward is the great Canadian Pre-Cambrian Shield above referred to. It has its narrowest point at North Bay, and spreads like a giant fan to the north, north-east and north-west, attaining a width of perhaps two thousand miles at its widest point where it reaches into the arctic circle. This great stretch of territory has been described by geologists as the vertebra of the earth. This is believed to have been the debutant of geological time, having probably been the point where earth first projected above the sea. The series of rock formations over the greater part of the area are essentially metal-bearing.

Ontario's Silver Mines

Silver was first discovered in Cobalt in 1903. The discovery was the direct result of the construction of the Temiskaming and Northern Ontario Railway. The veins at outcrop were exceedingly rich, but were extremely narrow—being measured in inches. Not a few experienced mining men predicted a short life for the mines that were subsequently developed. The production of 303,610,836 ounces of silver bears testimony to the inaccuracy of the early predictions. The dividend record of $81,000,000 is material evidence that the deposits have been worked with a high degree of commercial success.

As to the present, the silver mines of the district are producing at the rate of about $1,250,000 monthly. An average of about 30 mines are being operated.

The important producers amount to about one-half that number. Working forces engaged total about 2,700 men. An abundant supply of motive power is generated in hydro-electric plants located on the Montreal River, within a few miles of Cobalt. For the operation of machines, etc., compressed air is supplied by a 5000 h.p. hydraulic air compressor plant located at Ragged Chutes about nine miles from Cobalt.

The largest silver producing mine in the district is that of the Nipissing Mining Company. This property produced 3,731,892 ounces of fine silver during 1919, thus clearly demonstrating great physical strength despite its age. The mine is rated among the leading silver producers in the British Empire.

Silver deposits in Northern Ontario are not confined to the producing area of Cobalt. The silver-bearing formations cover a large area. The Casey-Cobalt mine situated fifteen miles north-east from Cobalt has been a heavy producer of silver, while the Wettlaufer mine, 15 miles south from Cobalt, produced large quantities of silver ore. In the Gowganda district about seventy miles north-west of Cobalt the Miller Lake-O'Brien mine is located and is producing about $1,000,000 a year. The intervening territory offers abundant scope for further exploration.

The Gold Mines

The gold mines of the Porcupine district, though having only commenced production in 1910, had up to the end of 1919 produced $54,205,836 out of the total of $58,871,757 produced by the entire province of Ontario during the ten years referred to. Perhaps the most significant feature in connection with the gold mining industry of this district is the fact that during 1919, the province of Ontario produced a total of $10,451,688 in gold, of which Porcupine accounted for $9,941,804. Both for the province as well as for the Porcupine mines, the 1919 achievement was the best in their history.

The leading gold mine in Canada, in fact the leading gold mine in the wetsern hemisphere, is the Hollinger Consolidated Mines, Limited, located in the Porcupine field. This mine during 1919 recovered a net value of $6,722,266.81. It closed the year 1919 with an ore reserve estimated at $39,928,430.

The vast area over which gold-bearing formation occurs has caused a significant phrase to be coined among even the most conservative mining engineers, which is this: "The North has scarcely been scratched."

Gold mining, while having attained leading proportions in the Porcupine district, is being carried on successfully on other localities throughout Northern Ontario. For instance, at Kirkland Lake, some sixty miles south-east from Porcupine, there are four mines which are equipped with modern mills, each with a capacity of from 60 to 150 tons of ore daily. Mining has been carried to a depth of 700 feet, the average grade of the ore being $11.99 a ton. This compares with an average of $9.19 a ton as demonstrated to date at the mines of the Porcupine district.

In the order of their importance, the five leading gold producing mines of Ontario are the Hollinger Consolidated, Dome Mines, McIntyre-Porcupine and Porcupine Crown, all four of which are located on the Porcupine field; and the Lake Shore, which is the leading property on the Kirkland Lake field. These five mines are each earning substantial profits, in the case of the Hollinger amounting to close to $2,500,000 a year net, after paying all costs and providing liberal allowance for depreciation.

At Superior Junction the branch line from Fort William connects with the main line. Smith Station is the centre of a district where hunting and fishing is good.

Re-entering Ontario Sept. 5

From Allenwater, 14 miles distant, the St. Anthony gold mines are located. At Ogaki there is a fine view of Sturgeon Lake, and the railway passes through a canyon of wonderful scenic beauty. Armstrong, population 300, is another railway divisional points. A mile east of Willet station the Mud River, a deep and navigable stream, flows into Lake Nipigon. The Kenah, Rapid, Seymour, Roaring, Marten, Camp and Mountain streams, all teeming with speckled trout, empty into the northern end of the lake.

Lake Nipigon if 852 feet above sea level, 70 miles long and 40 miles wide. Called "Great Bay of the North" by the Indians, it was not until 1860 that any official survey was attempted and in 1905 the Ontario Government set aside an area of some 7,300 square miles around Lake Nipigon as a forest reserve.

Between Penequani and Grant, a distance of seventy miles, the line is through a territory where gold discoveries have been made and claims have been staked in every direction.

Great water power awaits development along the Kenogami River, passed at Ogahalla, which flows through a virgin wilderness, heavily timbered with spruce and balsam, and with many smaller rivers emptying into it. Excellent farming lands extend to the east and west of the river, and several gold, silver, copper and zinc claims have been staked by prospectors along its shores.

The Ontario Government have an experimental farm underway along the Nagogami River and have been very successful in raising corn, cabbage, potatoes, wheat, oats, peas and barley.

Hearst is a divisional point and junction with the Algoma Central; population 500. At Macpherson, locally known as Kapuskasing, there is an experimental farm. The land was cleared by interned Austrians and Germans during the war. The land offered by the Ontario Government for homesteading reaches from Hearst to Cochrane and includes fifteen townships, exclusive of the two townships at Jacksonboro.

Cochrane is the northern terminus of the Ontario Government Railways and the junction with the Canadian Government Railways Line from Quebec and Winnipeg. It has extensive railroad yards and its future as one of the principal towns of the north is assured by its splendid geographical position. It has a population of 2,000.

At Cochrane the trains transfer from the Canadian National Railway lines to the Temiskaming and Northern Ontario Railway, owned by the Ontario Government. Then comes a twenty-five mile ride through two walls of spruce forest.

At Iroquois Falls on Lake Abitibi, on the branch line east, there is located one of the largest wood-pulp and paper plants of America.

Timmins
Sept. 6

Timmins, with about 5,500 population, is a mining town and the chief place in the Porcupine gold area. Its chief industry, apart from mining, is the Mattagami Pulp and Paper Mills. Porcupine, on Porcupine Lake, 479 miles north of Toronto, really includes Timmins, Schumacker and South Porcupine in its bounds, with a total population of 8,500. Near Seseki nika the trains cross the height of land—the Ridge Pole of Canada. Swastika, named after the Swastika Gold Mine which lies nearby, is as romantic as its name is old, for tumbling waterfalls and precipitous cliffs mark it as a centre of former volcanic activity. Near Dane a low-grade copper property is being opened up and development continues to go on in the goldfields at Larder Lake. Englehart is a thriving point where over $200,000 has been expended in erecting a handsome depot attractive parks and greenhouses, and homes for the railway employees. No better farming land can be found anywhere than in the vicinity of Englehart.

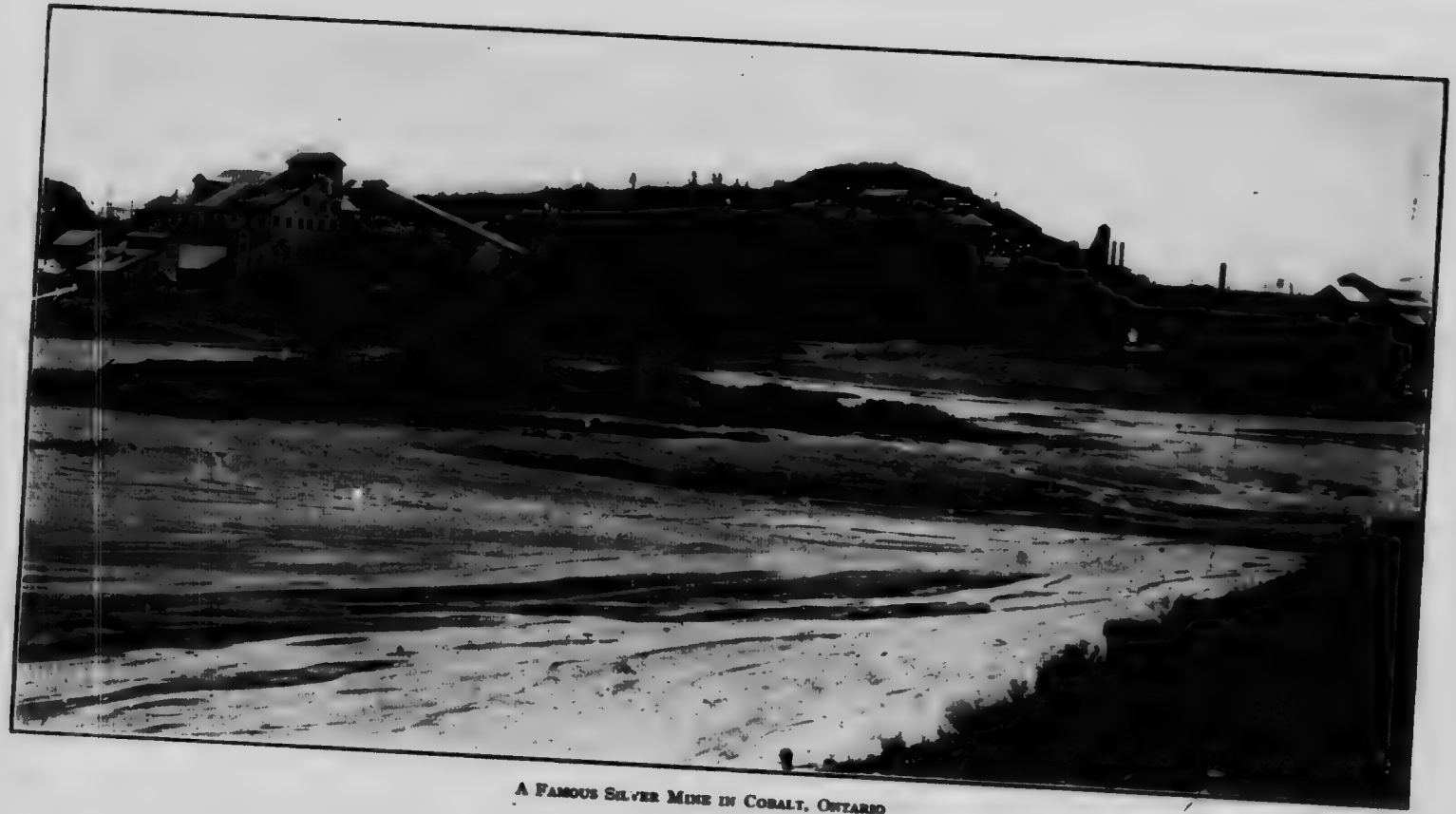
New Liskeard
Sept. 6

New Liskeard is the distributing centre for a rich country, known as the "Clay Belt." The vast new land which, roughly, may be said to extend from the Bell River in Quebec to 400 miles west of the Ontario-Quebec boundary, varying in depth north and south from 25 to 100 miles. The clay belt proper comprises an area of at least 16,000,000 acres of level or undulating ground, with an entire absence of stones. The soil is a rich clay or clay loam, and it is a safe statement that from 65 to 75 per cent. is good farm land.

Haileybury is the home of many of the Cobalt mining men. It is connected with Cobalt by the Nipissing Central Electric Railway, is the judicial seat of the new district of Temiskaming and one of the oldest and most beautiful towns in Northern Ontario.

Cobalt
Sept. 6

Cobalt is the famous centre of a silver region which has established itself in mining history. The most modern mining methods are adopted here and the underground workings extend in every direction. At Cobalt station can be seen one of the enterprises initiated with a view to winning an increased supply of the precious white metal. This is the basin of Cobalt Lake, now practically dry. This lake was pumped out in order to allow of mining operations under the bed of the lake and some of the



A Famous Silver Mine in Cobalt, Ontario

richest veins in the camp are now being worked here. Kerr Lake, a short distance from the town, was also removed from the map in a similar way in order to ensure the safety of mining operations under the bed of the lake. One of the great ore-crushing plants, the Nipissing, may be seen on the hillside across the lake from the railway, overhead ore conveyers taking the mineralized rock from the mine to be rushed. There is enough ore in sight to keep Cobalt busy for many years.

Leaving Cobalt, the trains pass Bay Lake, Johny Lake, and for six miles skirt Rib Lake, and then comes Temagami. Ten years ago an unknown wilderness, the Temagami Forest Reserve is the summer home of thousands of tourists, year after year. Lake Temagami has 1,600 islands and islets. There are 1,259 islands surveyed and marked on the Government map. Visiting four islands each day and remaining forty days each year, it would take you ten years to merely pay each one a flying visit.

At North Bay the trains leave the Temiskaming and Northern Railway lines and pass on to the tracks of the Grand Trunk. North Bay is situated on Lake Nipissing and is the principal town in a rich mining and lumbering district. It is an important interchange point between the railways and is the terminal of the northern division of the G.T.R. Its principal industries are engaged in utilizing the plentiful supply of lumber which the region affords.

At Scotia Junction, the Ottawa Division of the G.T.R. joins the northern division. The Algonquin Provincial Park of Ontario, in the centre of "The Highlands of Ontario," comprises nearly three thousand square miles of lake and woodland and is conceded to be one of the best resorts on the American continent for the angler and for the holiday-maker who loves the out-of-doors.

Huntsville is the point of entrance to the Lake of Bays district, a region of great natural beauty, comprising some of the most beautiful water stretches in this country of lakes. At Huntsville the passengers board a steamer of the Lake of Bays Navigation Company for a trip to Bigwin Inn, Canada's largest summer hotel.

Returning to Huntsville and boarding the trains the journey to Toronto is made during the night, passing through Bracebridge, the county centre of the Muskoka district, Gravenhurst, celebrated for its healthful air and its four sanitaria, and Orillia, a tourist centre and one of the most progressive towns in the northern districts, where that intrepid explorer, Samuel de Champlain, spent the winter of 1615-1616 on one of the most hazardous of his expeditions. Barrie, which has a variety of industries, supplied with cheap hydro-power from the Severn River, and serves a rich mixed farming and dairying district, is the next important point, and, one mile further on, is Allandale. Between Allandale and Toronto the prosperous farm is the feature of the landscape, the line passing through the Vale of Aurora. Newmarket and Aurora are prosperous little towns, doing considerable manufacturing. Holland Landing was visited by Sir John Franklin in 1825 on his first visit over land in search of the North Pole, the Holland River being one of the favorite routes used by the Indians and voyageurs en route to the Georgian Bay.

Toronto
Sept. 8

The route followed by the Grand Trunk main line between Toronto and Prescott takes the traveller along the northern shore of Lake Ontario, finally reaching Trenton, which is situated at the mouth of the wide and picturesque Trent River. It is the southern terminus of the Trent Valley Canal. Canal construction and other work have been completed, making a navigable waterway from Lake Ontario to the Georgian Bay. Twelve miles from Trenton is Belleville. As a market it is acknowledged to be among the best in central Ontario, as it is in the centre of one of the richest tracts of fertile and productive dairy, grain and fruit-growing land in the province.

The city of Kingston was a French fort in 1673 and was founded by Frontenac, the celebrated French soldier. In 1758 it passed into the possession of the British. A party of United Empire Loyalists chose Kingston as the location for their new home, and gradually the place assumed a position of importance in the new Canada. Finally Kingston was chosen as a garrison for British troops. When Upper and Lower Canada were united, Kingston was chosen as the capital. The policy of an all-Canadian Confederation was then the absorbing topic of political discussion. It is a matter of legitimate pride for Kingston that its representative in the first Canadian Parliament was Sir John A. Macdonald, the first Prime Minister of the Dominion. It is the seat of the Royal Military College, an institution which is deservedly famous all over the world. It is also the home of Queen's University, which for seventy-six years has sent out graduates all over Canada, "fitted to

A Famous Silver Mine in Cobalt, Ontario

serve their country in church and state." Last, but not least, it has achieved a steady and enviable progress as a business centre, having a population of about 24,000.

The Thousand Islands begin near Kingston at the outlet of Lake Ontario and extend some forty miles down the river to Brockville. They present everything conceivable in the way of an island, from a bare rock a yard across, to islands covering many acres, some heavily wooded, some covered merely with grass, some cultivated as farms, some containing beautiful summer residences and hotels. Many islands are hilly, while others scarcely rise above the water's surface.

Situated at the eastern end of the Thousand Islands, Brockville is a solid prosperous town of more than nine thousand inhabitants. It is one of the historic centres and in the war of 1812 was raided by United States soldiery from the neighbouring town of Ogdensburg, in the State of New York. Brockville subsequently joined in the assault and capture of Ogdensburg.

Prescott
Sept. 9

Prescott with a population of 2,800 is one of the most beautiful towns in the valley of the St. Lawrence. Among its principal objects of interest are old Fort Wellington, named in honor of the Iron Duke, and the tomb of Barbara Heck, the founder of Methodism in America. At Prescott the trains are left and a Canada Steamships Lines boat boarded for the boat trip to Montreal and Quebec.

Ogdensburg is the next stopping point and there the running of the Rapids is an interesting and to the inexperienced traveller, thrilling incident. The Galops and the Rapids du Plat are the first and least exciting. Next to come are the Long Sault Rapids, perhaps the greatest of the remarkable Rapids of the St. Lawrence, extending some nine miles down stream and divided into main channels by beautifully wooded islands. The steamer, with reduced speed is carried by sheer force of current through these seething rapids at a speed of twenty miles an hour.

At Cornwall the centre of the river ceases to be the boundary between Canada and the United States. Cornwall is on the G.T.R., a branch line of the C.P.R. and also on one of the N.Y. Central lines and is the terminus of the Cornwall Canal; there are four hotels, nine churches and three parks; its population is about 9,000 and there is good mixed farming, dairying and lumbering in the district with excellent fishing and hunting. The Cedar Rapid Power concern offers great electric power and it has industries which include furniture, cotton, bedsteads, lacrosse, chairs, paper and pulp. For the next thirty miles the river widens into Lake St. Francis. At the foot of the lake on the left is Coteau Landing, Quebec, where the little white houses and the big church indicate French Canada. After passing the village the steamer enters Coteau Rapids. The channel through this group of rapids is very torturous, winding in and out amongst the islands and crossing from bank to bank. Seven miles beyond are the Cedar Rapids, considered by those familiar with the river to be the most beautiful of all. The large electric development plant at this point is of much interest. In a few minutes come Split Rock Rapids, really the most difficult to navigate of them all, and immediately after this the Cascade Rapids, with their white crests.

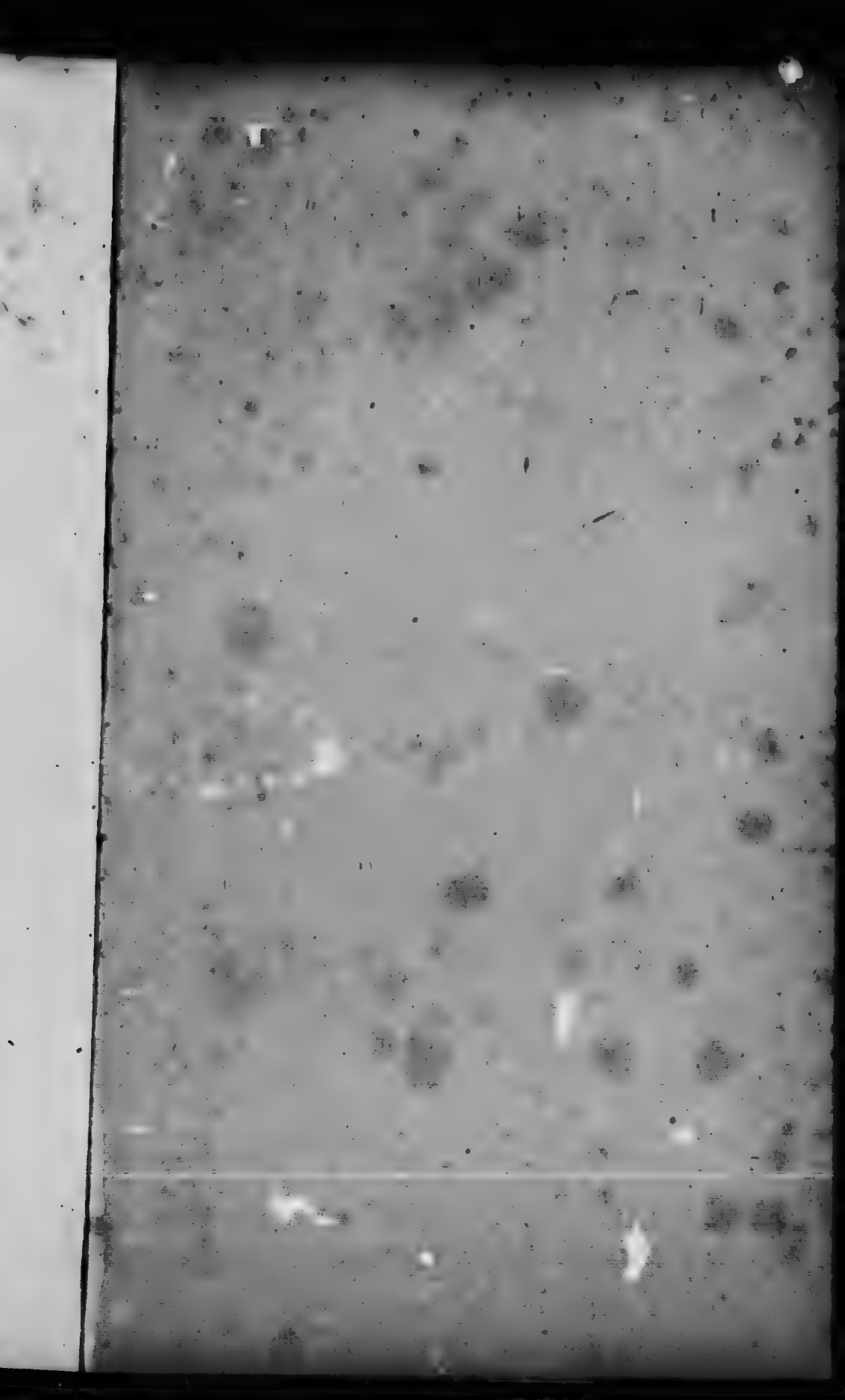
The Soulanges canal parallels the River on the north side, from Coteau to Cascade Point, and is a most interesting sight, being massively built of stone; operated and lighted by electricity. The river for the next twelve miles widens out, and is called Lake St. Louis, at the east end of which, on the north side is the town of Lachine, and opposite is the village of the Caughnawaga Indians. Lachine was for long the point of departure for the early French trading and military expeditions; from here in 1754 Duquesne set out to seize the Ohio Valley in an expedition which culminated in the defeat of Braddock. Then comes the Lachine Railway bridge, and shortly afterwards the Lachine Rapids, the last of the chain. The channel here is narrow and tortuous. The steamer plunges in among the breakers, and the headlong current carries her on towards insidious rocks, sometimes hidden, sometimes exposed to view, with the dark suggestion of others unseen below the waters; deftly the steamer passes them by, within a few feet of their treacherous edges and through clouds of spray ascending from the churning abyss. A moment more and the descent is completed; very soon the steamer glides into the placid waters underneath Victoria Bridge to Montreal.

Montreal Sept. 9

From Montreal where the tourists transfer to another C.S.L. boat for the last leg of their Canadian trip, to Quebec the scenery is pleasant, charming, tranquil, and places bearing names famous in French and Canadian history—Longueuil, Boucherville, Varennes and Verchères, are passed in rapid succession. Longueuil has 6,000 people and is on the opposite shore from Montreal, with two local railways and the Delaware and Hudson running into it; there are frequent ferries to Montreal, and the town possesses three hotels, three churches, a Roman Catholic college, two convents and three banks; the chief industry is the Armstrong-Whitworth Steel plant. The next important point is Sorel at the mouth of the Richelieu River, the northern outlet of Lake Champlain; it is on the C.P.R. and has four hotels and three churches, a population of 9,500 and large industrial and ship-building interests; its factories include agricultural implements, sash and door, foundries, plumbers' supplies, native wines, clothing, aerated waters and an abattoir. For the next thirty miles the river widens out into Lake St. Peter, and at the foot of the lake a stop is made at Three Rivers, near the delta of the St. Maurice River. This was the third of the French settlements, having been founded in 1634 with Tadousac and Quebec as the other two. It is at the head of tidewater on the St. Lawrence and here is located the Canada Steamship Company's shipbuilding plant and repair shops. It was incorporated in 1857, and is on the C.P.R. while a ferry to the south shore connects it with the G.T.R., the Canadian Government Railways and the Delaware and Hudson; it has a fine harbour, two miles of concrete wharves and is the county seat and the seat of a Catholic cathedral. There is a Roman Catholic college, several convents, nine schools and seven banks with a population of 22,000; the chief hotels are the Sanitarium, Dufresne, St. Louis, and there seven others. It is a centre of the paper, pulp and wood industries with six large lumber mills and three pulp and paper mills; there are four iron foundries, a steel foundry and a cotton mill, while machinery, boots and shoes, caskets, gloves, furniture, biscuits and candy are also make. The electric power is cheap with 250,000 h.p. developed.

Continuing the journey through the night, the boat arrives early in the morning of September 10, at Quebec where the Canadian tour of the second Imperial Press Conference covering 8,589 miles and lasting 46 days comes to an end.

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The same diversion of nerves takes place in the lumbar region, where the lumbar plexus is distributed to the inferior extremity, and, as a consequence, the symptoms of visceral disease may appear in the leg.

In addition to the disarrangement from the primitive plan of the limb nerve-supply, the organs themselves have shifted their position, such organs as the heart and stomach being situated further back, while the testicles migrate far away from their embryonic position.

In consequence of this the symptoms arising from a viscus may be exhibited at some considerable distance from the situation of the viscus.

CHAPTER X.

PRELIMINARY EXAMINATION OF THE PATIENT.

53. *The Patient's Appearance.*
54. *The Patient's Sensations.*
55. *Facial Aspect.*
56. *The General Condition.*
57. *A Review of all the Organs.*

53. The Patient's Appearance.—Before entering upon the physical examination of the patient, the physician ought to obtain a clear and comprehensive appreciation of the patient's own sensations. I therefore wish to insist upon the importance of the preliminary examination, which may be of more value in arriving at a correct estimation of the patient's condition than the most elaborate methods of physical examination. The attempt to appreciate the patient's condition should begin when first he presents himself. On his appearance in the consulting room, his bearing, his gait, the condition of his respiration, the colour of his face, any nervous peculiarity in his manner of speech and behaviour, and so forth, should be noted. If he is in bed, note the position he assumes, and any change in his colour or respiration in response to such exertions as talking or turning over. By habit one unconsciously notices these things, and as the examination proceeds, first one trivial matter, then another,

may arise, which helps materially in guiding the examination, and in forming the final opinion.

54. The Patient's Sensations.—After ascertaining the patient's name, age, and occupation, ask him to describe briefly his chief symptoms. After this inquire into the history of any previous illnesses or circumstances that may have a bearing on his present condition, as the nature of his work, condition of worry, bygone adventures, and hereditary pre-disposition. The data thus elicited will serve as a guide into a further inquiry into the symptoms of which the patient complains. This should be undertaken with the greatest minuteness, and the answers should be precise and definite. When the patient refers to his feelings get him to indicate the location by placing his hand over the region, and on no account be content with his assertion that his sensation has been felt in some viscus, as the stomach, heart, bladder. When any disagreeable sensation as pain is complained of, get a clear knowledge of the very earliest circumstances under which it was produced, the situation in which it was first felt, and the areas into which the pain spreads. In the same way, if it is breathlessness, the first sign of its appearance and the circumstances that induced it. In putting the questions the doctor should have a definite purpose in view, based on the statements of the patient, but the questions must not be put in such a manner that the patient will divine the drift. It may be necessary, however, to ask leading questions, when it is suspected that other symptoms may have been present which the patient has overlooked. For instance, I have found patients dwell upon symptoms referable to the epigastric region and assumed to be gastric in

origin; further inquiry as to whether there had been any pain in the shoulder has frequently brought forth the answer that severe pain had been felt on the top of the right shoulder, but it was thought to be rheumatic or neuralgic. The recognition of this pain then leads to the suggestion that all the symptoms may be due to gall-stones. In the same way, in obscure cases of pain in the lower part of the abdomen, the question whether the testicle was ever sore and tender has sometimes brought out the answer that the breeches seemed at times too tight, and were supposed to be the cause of the testicular pain. The presence of this testicular pain in such cases is often suggestive of renal calculus.

It will be frequently found that the symptom, such as pain even of the most severe type, is described so vaguely that no definite idea can be found in regard to its manner of onset, site, or radiation. In such cases, if the patient be asked to note these particulars next time the suffering arises, he will often be able to give a very clear and instructive account of his symptoms.

I have said that a patient's answer that pain, or any other sensation, was felt in an organ should never be taken. I may add a warning to the doctor not to make a note of the sensation by attributing it to any viscus; thus, a pain should not be noted as felt in the heart, stomach, liver, or lungs, but only in the region indicated by the patient's hand, for it will probably be found, on later examination, that the pain was not felt in the viscus. In other words, he should make no notes that might prejudge the nature of any symptom until he has all the evidence before him.

The results of this inquiry will be a guide in the

physical examination of the patient, when corroborative evidence may be found in areas of hyperalgesia of the skin and muscles, in contracted muscles, or in functional or structural symptoms in certain of the viscera.

55. Facial Aspect.—The first glance may at once dispel the consideration of a large group of complaints, as when a face is healthy-looking and well-nourished there is no need to fear the presence of any malignant or exhausting complaint. When there is an absence of this healthy tinge the recognition of the faint and subtle changes is useful. A slight duskiness of the cheeks or lips indicates imperfect aeration of the blood, and leads first to the consideration of the pulmonary or cardiac condition. A faint tinge of yellow in the duskiness raises the suggestion of liver engorgement. This faint yellow tinge is present in many conditions, as in pernicious anæmia, malarial cachexia, and the cachexia of malignant disease. A mere suspicion of jaundice of the skin and conjunctiva, as in certain cases of gall-stone disease, may give to the face the suspicious look of a malignant cachexia, and so also will certain forms of heart failure, particularly that form which is often accompanied with wasting. In the latter case the evident heart trouble gives a key to the nature of the enlarged liver, which is usually present. A dirty greyish aspect is sometimes seen in aortic disease.

Pallor is a common feature, and while it may indicate an anæmia (as chlorosis), yet it is natural to many families, and one not infrequently sees such people undergoing treatment for "anæmia." In elderly people the pallor may indeed be associated with various complaints, and it is often difficult to

tell what importance should be attached to the symptom. I think on the whole the presence of a sallow tinge is the most constant sign of malignancy —bearing in mind what I have just said of the presence of a slight jaundice in heart affections and gall-stone. When people past the middle age suddenly develop a pallor, the sign is one of grave significance, and may be the first clue to the beginning of some malignant affection (pernicious anæmia). Other conditions should be recognised, as the flushed turgid countenance of Graves' disease. The staring eyes, while manifestly indicating the nature of the complaint, may not be very distinctive, but a slight prominence, which may momentarily increase while the patient is being questioned, may be detected.

It is not possible here to detail the many other instructive signs which the facial aspect presents, as in paralysis, but I quote the foregoing as being the most common, and would insist on the routine study of the face all the time the patient is being questioned. As a disease progresses the facial aspect should be watched. In some, particularly in children, a sunken expression may appear in the course of an attack of diarrhœa or pneumonia, due to a shrinking of the contents of the socket and of the cheeks—often heralding a fatal issue. In the course of a typhoid fever the dull look of indifference may gradually be seen to creep over the face. A gradual change in the colour may be imperceptible to the doctor who sees the patient day by day, but is marked at once by one who sees the patient for the first time, and this change—a slight pallor, or a slight yellow tinge—may be the earliest sign of a malignant disease (pernicious anæmia, cancer).

56. The General Condition.—It is undoubtedly a misfortune that the study of what is called "temperaments" has fallen into disuse. My own experience tells me that the neglect of this method of observation is continually leading physicians and surgeons astray. This is particularly the case with those who devote themselves to some speciality. The possession of certain temperaments, particularly the neurotic, leads to exaggeration of the reflex symptoms, and a trifling complaint is thus often mistaken for something more serious. We find such patients passing from one specialist to another, each one attributing the complaint to the fault of some organ which came under his special purview.

Although it may not be possible to differentiate exactly the six temperaments of Laycock (nervous, sanguine, phlegmatic, bilious, lymphatic, and melancholic), yet the consideration of each individual's temperament should help us to estimate at its due value the patient's symptoms and the account of his or her sufferings. While we may not be able to classify temperaments with accuracy, yet in every case the mental attitude of the patient to his complaints should be borne in mind. Although, in a general way, each individual is so constituted that his temperament is a matter of inheritance, yet it can be modified by circumstances. This is particularly seen in people who become "neurotic" in consequence of mental worry or long continuous bodily suffering.

The characteristics of a patient's temperament come out generally in the course of the preliminary examination, in the manner, movements, and description of the complaints.

57. A Review of all the Organs. — In the

examination of patients the need for a thorough inquiry may demand that all organs should be inquired into. It is, however, not feasible or even necessary in the great majority of cases to make a systematic examination into the condition of each organ.

In an obscure case, and in cases where there is some complication, and when there is time and opportunity, no examination can be too careful or too thorough. But the great majority of cases with which the general practitioner has to deal do not present such complicated features, and the preliminary inquiry into the patient's symptoms gives a clue to the organ chiefly at fault, so that it is unnecessary that all the other organs should be submitted to a detailed physical examination. It is difficult to be certain when such thorough examination may be considered unnecessary, since, through its neglect, many ailments may be overlooked. To guard against this, many general practitioners have devised for themselves methods which serve to guide them in the detection of affections of organs other than that of which complaint is made.

In the logical and thorough cross-examination to which the patient is first submitted, a fair idea can generally be obtained of the organ or region in which there is trouble. Before examining more specially that part, inquiry should be made into the functions of other organs. These may be at fault, and may in reality be the real seat of the trouble, and the patient, in describing the more prominent features of his complaint, may have ignored some, to him, trivial sign, which the systematic interrogations may bring out. This inquiry need not be time-robbing if the physician makes his questions clear and distinct, and insists that the patient's

replies should be precise and to the point. In his inquiries the physician should have some system in his own mind, so that each question bears upon the symptoms of a single organ and has a definite significance. Thus, after having exhausted the information of the particular complaint, and having observed in the course of his inquiry the general aspect of the patient, as already described, he should then carefully question into the condition of other organs, beginning as a rule with those related by position or function to the complaint of the patient. Step by step each organ is referred to, and any that may show evidence of derangement are reserved for fuller investigation. To do this the essential symptoms of derangement of any organ must be kept in view. Thus, an inquiry is made into the condition of the heart and circulation by asking if the breath is as good as ever, or if he has palpitation or breathlessness on running up stairs, beyond what one would expect from his age and habits; into the lung condition by the presence of a cough, or of trouble in the breathing; into the digestive system by the presence of discomfort at any time before or after meals, and by the movement of the bowel; into the urinary system by the frequency of micturition, and particularly as to whether the patient has to get up in the night to pass urine. By following such lines as these, often guided by some incident in the patient's history or appearance, it will usually be found that no essential sign is overlooked. In all cases the patient's replies must be as direct and to the point as the question asked. The tendency to prolixity, which many patients show, must be firmly repressed; a clear reply should be obtained to each question, and no

question allowed to pass until the answer is obtained. The patient may be so full of his own view as to his condition that there may be some difficulty in restricting him to the subject the physician has in his mind, but if the physician will but be persistent in his method—having a clear conception in his own mind as to what he requires—the patient can usually be induced to give clear and coherent replies. According to the tenor of the replies the subsequent physical examination will be guided. In drawing conclusions from the results of the examination it is necessary to consider the bearing of any abnormality, or supposed abnormality, on the sufferings of the patient. It often happens that the complaint from which the patient suffers is obscure, and the cause difficult or impossible to determine. Should some other abnormality be present, which is easily recognisable, then there is a great tendency to attribute the symptoms to this demonstrable abnormality.

A patient of mine, suffering from some obscure abdominal complaint, consulted a gynecologist, who, finding an ovary which he considered too large, put all the trouble and suffering down to this, and removed it. Obtaining no relief, the patient sought the opinion of a surgeon, who, finding a slight dilatation of the stomach, put all the symptoms down to that, and performed a gastro-enterostomy, also without relief to the patient. In youth and in old age certain forms of irregularity of the heart are present in so many people that they may almost be looked upon as normal, and have no main bearing upon the patient's condition, yet when these patients are found suffering from any obscure condition, as weakness, fainting, or even epilepsy, the diagnosis

is often based upon this irregularity, though its nature is not understood. To many minds it is satisfying to detect an abnormal sign, even though it has no connection with the complaint from which the patient suffers. This tendency to be misled by the detection of an abnormal sign is seen very frequently in patients who may have a cardiac murmur. All sorts of symptoms can be referred back to this, and treatment for an innocent murmur is often undertaken with unnecessary energy to the neglect of the essential cause of the patient's suffering (*see* Chapter XXI.).

CHAPTER XI.

SYMPTOMS OF AFFECTIONS IN THE REGION OF DISTRIBUTION OF CEREBRO-SPINAL NERVES.

58. *Headache.*
59. *Sensory and Motor Symptoms.*
60. *Differential Diagnosis.*

The functional and organic symptoms of affections of the external body wall and the limbs are usually so manifest that it is not necessary to deal with them. Here certain phenomena are discussed, connected more particularly with the reflex sensory symptoms.

There are many phenomena resulting directly from stimulation of some part of the external body wall and limbs, which, at first sight, are not easily understood, and which often simulate the symptoms of visceral disease. It is necessary to allude briefly to the more important of these.

58. Headache.—There is much obscurity in regard to the mechanism by which the pain of headache is produced. I have made a number of observations in all kinds of headache, and must confess that I see no clear explanation. The conditions inducing the headache, or associated with it, are so varied that all sorts of theories can point to some circumstances for their support.

Certain forms of headache stand out very distinctly, and are of considerable diagnostic value, such as the headache associated with cerebral tumour, kidney disease, migraine. Others may arise reflexly from some peripheral irritation, as eye-strain, but I am somewhat doubtful of these cases said to arise reflexly from more distant organs, as from the abdominal viscera. A stomach headache is the most common, but as absorption of toxins takes place so readily from the digestive tract, I am not clear as to the real nature of headache of this class.

The real confusion arises because of our inability to identify the structures in which the pain is felt; whether, for instance, it is in the scalp or in the membranes of the brain, or whether the real seat may be in the central nervous system, and the pain referred to the periphery. Whether the membranes of the brain are sensitive or not still seems to be a matter of some doubt, and, personally, I have not had sufficient opportunity of testing these membranes. Even if it were the scalp in which the pain was felt, we would have to question and consider what part of the nerves is stimulated, whether, for instance, their peripheral distribution, or some deeper part. The variations of pain in the head, as felt by individuals, would seem to point to the stimulation arising in different places, and it is probably for this reason that so many theories can be found to explain headache.

59. Sensory and Motor Symptoms.—The view here expressed that pain is a function peculiar to certain nerves of the cerebro-spinal system, necessitates the consideration whether any given pain is referred (*i.e.*, originates reflexly from some viscus), whether it is due to some lesion of the tissues

supplied by the sensory nerve, or whether it arises from some affection of the nerve itself. In considering this subject it must be remembered that pain stimuli originating in the external body wall may be referred to other parts, and may be accompanied by muscular contractions—symptoms of the same nature and mechanism as the viscero-sensory and viscero-motor reflexes. This is notably the case in joint affections, where the pain is not infrequently referred to areas at some distance from the joint. The best instance is the pain felt on the inner side of the knee in disease of the hip joint. As a matter of fact the pains caused by joint affections are nearly all felt at some distance from the joint. Thus, pain in affections of the shoulder joint may be felt down the arm as low as the elbow, and the pain from the knee joint may be referred over the head of the tibia. In many joint affections the contractions of the muscles that move the joint may be so strong as to lead to the idea that the joint is anchylosed. This is particularly the case with some affections of the shoulder joint. The joint may be immobile until the patient is deeply under chloroform, when it will be found freely movable. There can be little doubt that the pain and the muscular contraction are due, not to a local stimulation of the peripheral nerve, but to a central stimulation. Hilton had called attention to the resemblance of the symptoms in joint affections to those of affections of serous cavities like the abdomen, and there can be little, if any, doubt that he was right. The knee pain is usually put down to a stimulation of a peripheral nerve that supplies the skin on the inside of the knee, but though the pain is felt in the distribution of this nerve the real explanation is that there has

passed from the hip joint into the spinal cord a stimulus which has excited the cord at the level from which the obturator nerve arises. At this level there also pass out the nerves supplying the muscles around the hip joint, so that in addition to the pain there is the stiffness and contraction of these muscles. This stiffness is comparable to the slight hardening or increase in tone of the flat abdominal muscles in visceral disease, while the permanent contraction is like the hardened abdominal muscles in visceral disease, and the conditions are due to an irritable focus in the spinal cord at the level of the third or fourth lumbar segment produced by the lesion in the hip joint.

This view of the cause of symptoms opens up the question of the nerve-supply of joints and the sensitiveness of the synovial membrane. I lean to the idea that the synovial membrane, like the peritoneal, is insensitive to direct stimulation, and that the pain arising from its stimulation is referred. This may, perhaps, mean that the nerve-supply of the joint arises not from the cerebro-spinal nervous system, but from the autonomic. Pain may arise from the contraction of muscles due to an increased sensibility of the muscle, as well as from irritability of the nerve-centres, as in reflex hyperalgesia. In certain forms of rheumatism muscular contraction may be present, giving rise to the "stiffness" in the joints, best observed after a long rest. With gradual exercise of the muscles the stiffness passes off.

Pain may arise from violent spasmodic contraction of the muscles, as in cramp. The pain in what is called muscular rheumatism is often due to contraction of voluntary muscles, as in lumbago, stiff-neck, pleurodynia.

While these contractions are usually due to some temporary affection of the muscles, similar contractions may arise from irritation of the motor nerves by some disease process as spinal caries.

60. Differential Diagnosis.—On account of the fact that pain originating in any part of a nerve in its course from the brain to its periphery is referred to the peripheral distribution, there is often a difficulty in determining the source of the pain stimuli. The differential diagnosis must, therefore, depend on a knowledge of how the pain arises, the relationship of the nerve-supply of different regions of the body to the central nerve-supply, and its connection with the visceral nerve-supply. In the absence of any demonstrable cause of stimulation at the periphery it is necessary to consider the possibility of stimulation at more central parts. The symptoms that may arise from an irritation of a nerve-trunk, as from pressure, neuritis, or herpes zoster, resemble in a great many respects those that arise from visceral disease. So great, indeed, is this resemblance that even the most experienced may be led astray. Thus, the pain and hyperalgesia of a stomach affection may simulate the symptoms produced by caries of the spine (*see* page 66), and the shoulder-pain of gall-stone disease may be mistaken for a neuritis.

It might have been supposed that pain due to the stimulation of a nerve at its periphery, or at its trunk, would have had a distribution peculiar to the peripheral distribution of the nerve branch so stimulated. If the region of the pain had been limited to the part of the periphery stimulated, or to the distribution of the nerve trunk, such a limitation of the field of pain in hyperalgesia might

have given the desired indication, but, as has already been shown (page 27), the stimulation of the periphery of a sensory nerve, or of the trunk, causes a spreading of the pain by reason of a central radiation. It follows that a local irritation may produce such widespread phenomena as to simulate central irritation. It is for this reason that the various forms of "neuritis" so closely resemble the pains of visceral disease, pains due to pressure on the trunk of the nerve, or herpes zoster.

For the purpose of differential diagnosis it is necessary to know how the pains of visceral disease arise and spread. This knowledge can only be acquired by careful study of individual cases, for, though certain general laws underlie the production of these symptoms, there are differences in individual cases. In doubtful cases the knowledge that in visceral disease certain associated phenomena can arise may often help to clear up a doubtful case. So far as I can I deal with the characteristics of the symptoms in the organs I have been able to study. This description is far from complete, and does not take into consideration symptoms that arise from certain viscera (as the pancreas or spleen), because I have had no opportunity of studying the symptoms in these cases with sufficient precision, and the descriptions usually given are too indeterminate to be of real value.

Before deciding that any given case is a neuritis or a neuralgia, the possibility of visceral disease should be carefully considered.

CHAPTER XII.

AFFECTIONS OF THE DIGESTIVE ORGANS.

61. *The Nerve Supply of the Digestive Tract.*
62. *Distribution of Sensory Symptoms in affections of the Digestive Tract.*
63. *Appetite.*
64. *Hunger.*
65. *Nausea.*
66. *Mouth and Fauces.*
67. *Tongue.*
68. *Swallowing.*
69. *Œsophagus.*

61. The Nerve Supply of the Digestive Tract.—The nerve supply of the digestive tract is derived partly from the autonomic and partly from the cerebro-spinal system. If one glances at Langley's diagram it will be seen that the autonomic supply is derived from three regions: (1) from the bulbar autonomic division by the vagus, distributed to the walls of the gut from mouth to descending colon; (2) from the sympathetic division by the splanchnics, which supply the stomach, small intestine, and greater part of the great intestine; and (3) from the sacral autonomic division, which supplies the descending colon and rectum.

The cerebro-spinal nerve supply is limited to the oral and anal orifices. The sensations at the

oral end are divided into those of common and special sensations. The sensory nerves are derived from the fifth cranial and glosso-pharyngeal, and supply the mouth, fauces, and a small portion of the upper end of the œsophagus—the exact extent has not been accurately defined. The mouth differs from the skin in sensibility, touch being less acute and less perfectly localised, though temperature sense and pain are well developed. The nerves of special sensibility (taste) in the tongue are derived from the glosso-pharyngeal, fifth, and chorda tympani nerves. The olfactory nerve, too, must be considered as an accessory nerve of digestion, for it has remarkable effects in stimulating reflexly the salivary and gastric glands, and also in the appreciation of taste. It has also, at times, a powerful effect in inducing attacks of vomiting.

The distribution of the cerebro-spinal system of nerves to the anal end of the gut is of very small extent, being limited to little more than the inner side of the external sphincter. So far as I have been able to make out, the mucous membrane covering the internal sphincter is devoid of direct sensation.

62. Distribution of Sensory Symptoms in affections of the Digestive Tract.—The nature of the nerve supply explains the character of the sensory symptoms evoked by affections of the digestive tract. Limiting the study at present to the subject of pain, it will be found that from the top of the œsophagus to the anus there is, in the great majority of instances, a limitation of the distribution of the pain to an area extending down the centre of the body from about the middle of the sternum to the symphysis pubis (shaded area in fig. 8).

If pain be produced by stimulating the œsophagus,

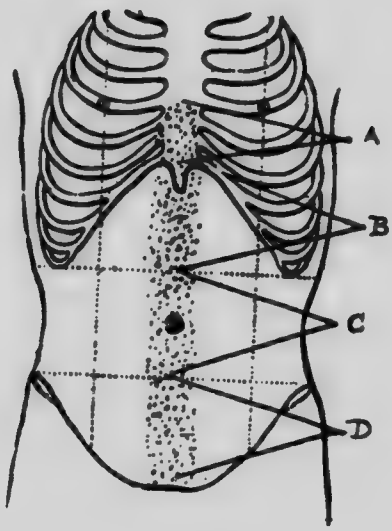


FIG. 8.

The shaded parts show the areas in which pain is felt in affections of the digestive tube.

A. Area in which pain is felt in affections of the œsophagus.

B. Area in which pain is felt in affections of the stomach.

C. Area in which pain is felt in affections of the small intestine.

D. Area in which pain is felt in affections of the large intestine.

as, for instance, by a hot drink, the pain is always referred to the region over the lower part of the sternum. Usually this pain is supposed to be "in the œsophagus," but if it were in the œsophagus there is no reason why it should not be felt better in the back, for the œsophagus is nearer the posterior cutaneous surface than the anterior. Pain arising from the stomach is limited, in the vast majority of cases, to the epigastrium. The best idea of intestinal pain is found in watching a case of peristalsis of the bowel. A painful peristalsis may start with pain referred to the lower part of the epigastric region, then it slowly descends with a grinding intermitting severity until it reaches above the pubis, when the call to defecate becomes urgent, and relief is at once found with the expulsion of a loose motion. In such an instance the fluid has traversed the whole intestinal tract, and the peristaltic waves have passed into all quarters of the abdominal cavity, yet the pain has descended in an even and unvarying direction down the centre of the abdominal wall.

It is well to remember this feature of pain due to peristaltic contraction of the gut, for it will be found of frequent diagnostic importance in solving the source of severe colic-like pains. As already remarked, contraction of non-striped muscles is the most frequent cause of violent visceral pain, and, as a rule, when the pain is violent, it can be very accurately localised. This limitation of the pain to the middle line of the body is characteristic also of the pain of other hollow viscera, as the gall-ducts, uterus, and bladder, while the pain of renal colic (contraction of the ureter and pelvis of the kidney) is distinctly unilateral.

63. Appetite.—All actions that are performed periodically or intermittently, in which volition participates, are accompanied by sensations which make known the time when the act has to be performed. These sensations are in themselves not unpleasant at first, but are accompanied by a desire to perform voluntarily an act which will gratify that desire. Thus, if the breath be held the desire to breathe is not painful, but there is a longing for the sensation of full inspiration. So, in regard to the call for micturition and defecation, the sensation is one calling for the gratification of a sense of relief. To this category belongs the desire for nourishment, liquid or solid—the appetite.

Appetite itself is a sensation so vague that no definite description of its mechanism can be given, though it is probably dependent on the digestive glands in the mouth and the stomach. The consciousness of appetite is accompanied by increased secretion of these glands—so much so, that even the contemplation of a satisfying meal may cause the "mouth to water." The appetite or desire for food may be increased by the sight, or odour, of tempting viands, or even by the mental contemplation of them, and an abundant flow of the gastric juices may result from such stimulation.

The production of normal appetite follows the efficient absorption of food and its expenditure in the production of energy. Thus it is seen at its best in those who work in the open air. The gratification of an appetite being amongst the most elemental of pleasures, the presence of appetite is a rough indication of health. Man's environment so often prevents its display that means are

taken to excite an appetite by providing food in a manner that will supply the craving.

These artificial aids, used to create appetite, diminish the value of this sensation as a diagnostic aid. The loss of appetite, as seen in animals (horses, cattle), is the most important sign of impaired health, and its return is an indication of restoration to health. In man also it has significance, but, as man resorts to all sorts of artificial aids, this significance is often diminished. Still the question of loss and return of appetite affords valuable aid in diagnosis. When an individual loses his appetite it may be taken as an indication that all is not well. The loss of appetite may, with reasonable probability, be referred to a diminished excitability of the secretory glands or their nerves. The secretory reflexes which are associated with appetite may be played upon in a great variety of ways, as by mental excitement, impaired metabolism (as in enforced rest), increased temperature and the agents inducing it, affections of the digestive tube and other organs. The symptom of anorexia—loss of appetite—therefore, merely indicates that there is something wrong in the economy. Further examination may reveal the cause, and the behaviour of the appetite may often prove a safe guide as to the progress or retrogression of the ailment.

Certain results follow the loss of appetite; the tongue becomes furred, the mouth unpleasant from the lack of the mechanical friction of the tongue against the palate and the absence of juices from the inactive glands, abdominal discomfort arises from the accumulation of flatus, and the bowels are inactive from absence of stimulus.

An increased desire or craving for food (boulimia)

may arise during convalescence from a long illness, such as typhoid fever. The craving is probably due to the tissues losing the poisoned fluids, returning to their normal state, and requiring suitable nourishment of which they were deprived during the illness. An abnormal appetite may be one of a group of symptoms, referable either to the nervous system, as in hysteria, or to conditions in which there is no sign of mental defect, as in chlorosis, diabetes mellitus, intestinal worms. Enormous quantities of food may be taken by those who are thus affected.

Craving for certain forms of food is a frequent sign, but there is often a craving for things that are not food, and that are not digestible. This perverted appetite may arise as a matter of habit, for the custom of eating earth (geophagy) is prevalent among natives of widely separated countries. In some cases the earth may contain nutritious properties, but in many cases it is used, not for its nutritive value, but merely for the gratification of a perverted taste. Perversion of appetite is common amongst the insane, but it is also present as a bad habit amongst others, as children, chlorotic females, pregnant women, and others who have no particular ailment. The objects eaten or swallowed are of the greatest variety, as chalk, coal, earth, plaster, ashes, pebbles, etc.

64. Hunger.—While the anticipation preceding the performance of a periodic act may be pleasant from the prospect of gratification, the undue delay of performance results invariably in the sensation becoming one of distress. Abstinence from food may convert the sensation of appetite into one of hunger, and hunger implies distress, and when

pushed to extreme is probably the most clamant of all desires. Hunger becomes more than a mere excess of appetite. Appetite is probably, as already stated, the outcome of the active stimulation of certain digestive glands, while hunger is the craving of the whole body for nourishment, and the digestive tract, with its limited sensations, is the vehicle for the sustenance of the whole economy. This is seen by the fact that hunger may exist when the stomach is full, the appetite gratified, but the food prevented from reaching the tissues in consequence of an intestinal fistula. Apart from hunger due to starvation, an increased craving can be induced by measures taken to stimulate the appetite, by cooking, and the various means of providing "tempting bits," and this may be carried so far as to become a perverted habit. Perverted tastes may arise, however, from custom, or as a symptom of disease.

65. Nausea.—The unpleasant sensation, nausea, is often associated with loss of appetite and certain affections of the stomach. Though it often comes on at an early stage in the act of vomiting, it may arise without vomiting, just as vomiting may occur without any previous feeling of nausea. It is associated with the digestive function, and its appearance is accompanied by a stimulation of some digestive glands, as shown by profuse flow of saliva. In certain affections of the stomach, as in the gastric catarrh of alcoholics, it is the most distressful symptom, occurring usually after a long fast, as in the morning before food is taken. It may arise suddenly from some reflex cause, as from a bad odour, an offensive sight, or the appearance of unattractive food. In addition to the disagreeable sensation there is often some

spasmodic contraction of certain muscles of the diaphragm with closure of the glottis, as in the preliminary stage of vomiting. Accompanying the nausea there is often a feeling of faintness, the pulse becomes soft, weak, and rapid, and the face blanched, due in all probability to the action of the vagus diminishing the force of the heart beat, and producing a vaso-motor depression.

65. Mouth and Fauces.—The pain complained of in affections of the mouth and fauces may be local or referred, or both. Local pain in the mouth may be present in inflammatory affections of the mucous membrane. In toothache it may be felt not only in the affected tooth, but in neighbouring teeth, and the jaw may become painful and tender. The pain may be felt so severely in places apart from the offending tooth that it requires some care to detect which tooth is at fault. The pain may be referred to outside the mouth, in the cheek, or in some portion of the head, and the skin may become very hyperalgesic. It is necessary in any case of "neuralgia" of the face and the head to carefully examine the condition of every tooth.

The fifth cranial nerve is particularly liable to stimulation from affections other than those arising from the mouth, and the presence of pain in the distribution of the fifth nerve may be due to a variety of causes. The most striking of these conditions is when there is some distinct affection of the nerve itself or the nerve ganglion, in the disease called trigeminal neuralgia or tic douloureux. Before the full character of this complaint is revealed in all its terrible characteristics, there is a period in which it resembles so closely the characters of a toothache, that at first it is almost

invariably mistaken for this complaint, and one decayed tooth after another is removed. The pain continuing to recur, the dentist next attacks the sound teeth, and not infrequently every tooth is removed, yet pain continues to recur in the edentulous jaw. Relief may be found after the removal of one or more teeth, but, as with the operation for nerve stretching, it is but temporary. It is not possible in the early stages to distinguish between a case of true tic and a toothache. In both the pains may recur at intervals, and, when there is hyperalgesia of the skin of the cheek in toothache, the resemblance between the two conditions is very complete. Thus, stroking of the hair may be exquisitely painful, may bring on a spasm of pain. When one decayed tooth after another is removed with no lasting benefit, then the true nature of the complaint may be suspected, but as one is loth to come to the conclusion that the case is one of true tic douloureux, the teeth extraction continues.

Another instructive form of pain occurs in certain forms of angina pectoris, where the pain is not only present in the chest and arms, but may be felt in the lower jaw and throat. The pain of angina pectoris may even start here, and be limited almost entirely to this region. The feeling is described as a sense of intense soreness along the lower jaw, akin to what is felt in some forms of toothache. The nerves supplying the fauces, and the voluntary muscles engaged in swallowing, may also be hypersensitive, so that the patient has a good deal of pain in swallowing. In rare cases, after a severe attack of angina pectoris, the patient may complain of pain in swallowing for weeks after the

attack has passed off. Doubtless, in such cases, the violent stimulation has reached the medulla and upper part of the cord by the vagus, and the stimulation has affected the sensory cells in the neighbourhood and left an irritable focus, as witnessed by the hyperalgesia of the muscles and mucous membrane shown in the act of swallowing.

Inflammatory affections in the fauces often cause great pain in the act of swallowing. When the tonsils are acutely inflamed the increased secretion of mucus continuously excites the act of swallowing and causes great distress. The pain is felt not only in the inflamed parts, but extends into the sides of the neck, and up into the ear. The skin of the neck behind the jaw may become hyperalgesic, and frequently there can be detected enlarged and tender glands behind the jaw.

A number of patients may complain of pain on swallowing, and when careful investigation is made it will be found to be due to a form of infection very common amongst those who use false teeth where the utmost cleanliness is not observed. The patient frequently complains of a sore throat, and if the fauces be inspected a slight redness of the pillars can be detected. If the patient wears a plate on the roof of the mouth, and this be removed, the underlying mucous membrane will be found swollen and red, and from this place to the fauces there can be detected an extension of the inflammation in the form of small red dots. Sometimes the surface of the mucous membrane, under the plate, may be covered with patches of thrush, and an infective process may extend to the parotid and sub-lingual glands, causing severe inflammation and swelling

of these glands. Inspection of the mouth may reveal other abnormalities, as ulcers.

A very interesting instance of referred sensation is seen in passing a bougie into the eustachian tube. When a catheter is passed into the eustachian tube for the purpose of insuflation, the sensation produced by the catheter is referred to the back of the nose. If a bougie be passed along the catheter into the eustachian tube, the sensation is at first referred to some place between the back of the nose and the ear. If the bougie be pushed further in, a part is reached where the sensation is suddenly referred to the neck behind the jaw. This transference of the sensation is doubtless due to the parts being supplied by nerve fibres from different sources —the exact nature of the supply I am unable to determine.

67. Tongue.—In health the tongue should be evenly and steadily protruded, moist, and of a slightly translucent pale red colour. A tremulous tongue should lead to an inquiry into the alcoholic habits, and an unevenly protruded tongue to the question of paralysis.

The principal cause of a furred tongue is absence of friction, usually due to deficiency of saliva and insufficient mastication. Too much stress has been laid upon the supposed association of the furred tongue with certain "catarrhal" conditions of the stomach and bowels. A person with no appetite has a furred tongue because he does not masticate. A person who bolts his food, or who washes his food into his stomach by drinking while eating, or who lives on "slops," has a furred tongue from the same cause. The posterior third of the tongue in some is always furred, and in these

it will be found that the palate is high and arched, so that the tongue does not come into contact with the roof of the mouth. Mouth breathers also have a tendency to a furred tongue, for the playing backwards and forwards of the air over the tongue dries it, and favours the formation of the fur. This is especially the case in fevers where the hot air passing over the tongue dries it. This tendency is further increased by the absence of mastication—the patient being so often fed on slops. In fever a fur may appear in spite of all precautions. A very striking prognostic sign may be found in carefully watching the tongue in febrile states, for the earliest symptom that the fever is about to yield, may be the appearance of a small clean spot on the tongue.

68. Swallowing.—The act of swallowing, so far as it is carried out within the region of distribution of cerebro-spinal nerves, is a voluntary and conscious act; but as soon as the bolus passes beyond into the region supplied by the autonomic nervous system, it becomes involuntary and unconscious. During the act the respiration is inhibited and the levator palati raises the palate and shuts off the nasal cavities. Bilateral paralysis of this muscle, as after diphtheria, leads to fluids regurgitating down the nose during the act of swallowing.

Pain accompanying the act of swallowing is due most frequently to some inflammatory infection of the tonsils or fauces. It is generally referred to the neck behind the jaw, or up into the ear. Inspection of the fauces will generally reveal the cause. In rare cases, as already cited, there may be a hyperalgesia of the mucous membrane of the muscles with a good deal of pain on swallowing.

There is sometimes shown a curious relationship

between the tonsils and the nerve supply of the external ear. In a number of cases I have found during a tonsilitis an attack of herpes zoster occur; the eruption appearing on the lobe and pinna of the ear. This has occurred so frequently that the association is more than casual, and I suspect some intimate central relationship between the nerve supply of these parts. Herpes zoster has been shown by Head and Campbell to be due to a destructive inflammation of the ganglia of the sensory root, and it is difficult to explain the definite relationship of the tonsilitis and the herpes on the ear, but the fact is one worthy of consideration in the investigation of the relationship of the viscera to the cerebro-spinal nerves.

69. The Œsophagus.—The nerve supply of the œsophagus being derived entirely from the autonomic system, we get no direct response to stimulation. Pain arises rather easily from stimulation, especially, as every one has experienced, on the drinking of hot fluids. The pain thus excited is referred distinctly to the front of the chest, and although the heart and lungs are interposed between the site of pain and the œsophagus, and although the œsophagus itself is nearer the back of the chest than the front, everyone unhesitatingly refers the pain as being felt in the œsophagus. Nevertheless, after a good many observations, I have come to the conclusion that the laws governing the sensibility of the œsophagus are the same as those governing the sensibility of the other portions of the digestive tube, and that the œsophageal pain is a referred pain and not a direct. That its sensibility is different from the stomach is, I think, undoubted. The pain in swallowing hot fluids, for

instance, is more readily induced by the œsophagus than by the stomach. Also, the stomach contents, though giving rise to no sensation when in the stomach, may cause great discomfort when they regurgitate into the œsophagus, and it is for this reason that I assign the disagreeable sensation of heartburn to the acrid stomach contents escaping into the œsophagus (*see* p. 137).

Some recent observations by Hertz, Cook, and Schlesinger, lead them to the conclusion that the sensation of heat and cold on swallowing fluids is actually felt at the lower end of the œsophagus, but their observations do not disprove, as they seem to think, the referred character of the sensation. The view I hold that the sensations of heat and cold are really due to a reflex stimulation of the peripheral vaso-motor nerves is not disproved because in some cases the sensation is felt "deeper" than the skin; and, although I am far from asserting that the hypothesis I put forward absolutely correct, the matter is not the simple o these observers seem to imagine.

In some cases, particularly in females of a neurotic habit, the moment a hard piece of food, as a small crust of bread, or even a soft bolus or fluid, touches the upper part of the œsophagus, the œsophagus at once contracts with such violence and persistence that no food can be taken for some time. Sometimes a small portion of food may be grasped in the spasm, when the spasm may last for hours, and the patient be in great suffering on account of the difficulty in breathing and the excessive flow of saliva that cannot be swallowed. The forcible passage of a bougie or probang at once gives relief. In a large number of cases I have found the

systematic passage of a bougie the best means of treatment. In some rare cases the seat of the spasm may be lower down.

In stricture of the œsophagus, if the stricture be high up the food is rejected at once, if low down it may be delayed for some time. Sometimes the œsophagus wall contracts strongly, and, as in obstruction of the bowel, pain may arise from the peristalsis, and is always referred to the front of the chest, at a level near that of the stricture. Great care should be taken in all cases in the passage of an exploratory bougie, lest injury be done to the walls.

CHAPTER XIII.

AFFECTIONS OF THE DIGESTIVE ORGANS. THE STOMACH.

70. *The nature of the Symptoms.*
71. *Nerve Supply of the Stomach.*
72. *The Site of Pain in Affections of the Stomach.*
73. *The Character of the Pain.*
74. *Hyperalgesia.*
75. *Superficial Reflexes.*
76. *Viscero-motor Reflexes.*
77. *Vomiting.*
78. *Pyrosis and Heartburn.*
79. *Air Suction.*
80. *Functional Symptoms.*
81. *Structural Symptoms.*
82. *The Diagnosis of Stomach Affections.*
83. *Pain in Gastric Ulcer.*

70. The nature of the symptoms.—The stomach being an organ that daily makes itself known by sensations of pleasure or discomfort, forces its symptoms upon all. Considering its highly complex organisation it is a wonderfully long-suffering organ, for it not only digests food suitable for the whole organism, but it has to submit to improper food, to the gratification of gluttonous desires, and to the caprices of perverted tastes. It cannot

be wondered at that it should so often become deranged in structure and function, and that these derangements should be of different kinds.

Its accessibility has permitted many observations to be made on its functions in health and disease, and has afforded scope for the ingenuity of the physiologist, the chemist, and the clinician. Although continual progress is being made in the discovery of its properties, it must be admitted that little of practical importance has been evolved for the purpose of diagnosis and treatment of the great majority of patients. So far as the physiologist is concerned he cannot acquire the necessary information, because symptoms of disordered digestion are usually the outcome of years of improper feeding. Food unsuitable for the digestive powers of the stomach deranges the functions of its secretory glands and the structures of its walls, and, it must be confessed, we are ignorant of the nature of these changes. It is for this reason that so little advance has been made in diagnosis and treatment, apart from the progress of the surgical methods, and those latter apply to but a very small proportion of sufferers from stomach affections.

Attempts are continually being made to classify affections of the stomach, and the lack of agreement in these classifications is merely due to the fact that attempts are made to differentiate what cannot be differentiated. This will be realised when the nature of stomach symptoms is considered. Apart from some characteristic vomits (blood, mucus), and certain changes indicated in the position of the organ (and these refer only to a minute proportion of the cases), all the symptoms are of a reflex nature, pain, cutaneous and muscular

hyperalgesia, muscular contraction, vomiting, air suction. As any adequate stimulus may suffice to produce these symptoms, and as this adequate stimulus may arise from the most varied causes, trivial or severe, it follows that there is a great similarity in the symptoms in diseases of the most varied kinds. Hence it is impossible in many cases to tell the nature of the affection; for instance, a passing simple "indigestion" arising from one indiscreet meal may present the symptoms of "gastritis" or ulceration. For this reason it often happens that no satisfactory diagnosis can be made in the early stages of a chronic stomach complaint. To ascertain the true nature of many stomach affections it is necessary to wait and observe the results of treatment and the progress of the disease. When patients come in a late stage of the complaint the peculiar features of any given disease may have become so evident that an accurate diagnosis can be made; but these form but a small proportion of the chronic cases that the practitioner has to treat.

I have already pointed out that in visceral disease certain areas in the spinal cord may become for a time so irritable that stimuli from the periphery give rise to an exaggerated response, as when the skin becomes hyperalgesic and the recti muscles contracted. This irritable focus in the cord is of great frequency in stomach affections. Not only does slight stimulation of the skin produce pain, but a stimulus reaching this irritable focus from any source may produce pain, and it is for this reason that the ingestion of food is so frequently accompanied by pain. When pain occurs after food it must not be assumed that there is an inflammation

of the mucous membrane, or that the stomach is itself hypersensitive. The ingestion of food under normal circumstances is accompanied by reflex processes which are not perceived, and pain merely indicates that there is an irritable focus in the cord through which these reflex processes pass. The lesion inducing the irritable focus in the cord may not necessarily be a stomach lesion at all, but may arise from a neighbouring organ whose reflex centre in the spinal cord is in close proximity to that of the stomach. In gall-stone colic the pain may be so violent as to invade the stomach area in the cord, and an illustration of the pain arising on the ingestion of food in a case of hyperalgesia due to gall-stone disease is given on page 86.

In true lesions of the stomach this irritable focus in the cord is readily produced, and its presence is demonstrated by the ease with which pain is induced in certain stages of digestion, by the hyperalgesia of the skin and muscles of the epigastrium, and by the hardened epigastric muscles.

71. The Nerve Supply of the Stomach.—The stomach is supplied by nerves from the spinal sympathetic and from the vagus. The origin of the sympathetic has not been exactly determined, as the experimental attempts to find the efferent fibres that supply the stomach have not been very successful, so that the place of origin in the spinal cord is best inferred from clinical observations of the area in which the pain and hyperalgesia arise.

The epigastric region is essentially the place where the sensory symptoms are recognised, and it is the upper part of the left rectus muscle which contracts first in response to stimulation from

the stomach. The nerve supply to the skin of this region comes from the sixth and seventh thoracic nerves, and the upper portion of the rectus is supplied by the sixth. When the pain is severe, and tends to radiate, it generally goes to the left of the epigastrium, but may invade the regions of the front of the chest supplied by the fifth and fourth thoracic nerves. I have seen the symptoms in rare cases resemble attacks of angina pectoris, and it has seemed to me that the cause of the pain in such cases was violent peristalsis of the cardiac end of the stomach.

The burning pain of heart-burn is generally felt over the lower part of the sternum, in the region of distribution of the fifth thoracic nerve in the chest. It has seemed to me that the immediate cause of this pain is the regurgitation into the œsophagus of the acrid contents of the stomach. The frequency with which in these cases some of the stomach contents regurgitate into the mouth confirms this view.

The result of vagus stimulation is difficult to determine in stomach cases. Pain may be felt in the neck and jaw in severe gastric colic, very like that felt in some cases of angina pectoris, and this, I can only conclude, is a stimulus reaching the fifth cranial and upper cervical nerve centres, by means of the vagus. The brow pain felt in swallowing ice is often spoken of as a vagal reflex, but this pain arises, not from the stomach, but from the back of the mouth. This can be demonstrated, in suitable cases, by keeping the ice against the soft palate, when the pain will be evoked.

In rare cases vagal stimulation, excited by swallowing or by the ingestion of food into the

stomach, can produce irregular action of the heart, of the nature of heart block, or of extra-systoles.

72. The Site of the Pain in Affections of the Stomach.—In 1892 I published a paper, in which I gave the results of a careful inquiry into the site of pain in 320 cases of affections of the stomach. In the analysis I found that 95 per cent. referred their pain to the epigastrium. Since that time I have kept records of some thousands of cases, with the same results. Whatever the nature of the lesion the pain is referred with great certainty to the epigastrium (B fig. 8, page 113). It may radiate from here up into the chest, or to the left. It is not infrequently accompanied by a pain in the back, and the patient sometimes states that the pain strikes from the front through to the back. It might be inferred from the situation of the pain that the pain itself was actually in the stomach, but one can demonstrate that it is really referred to the peripheral distribution of the cerebro-spinal nerves in the abdominal walls. Thus, in many cases, the skin and muscles in the area in which the pain is felt are hyperalgesic, and it is but reasonable to infer that the pain felt by the patient is referred to a region where the sensory nerves are so demonstrably affected. The movements of the stomach do not cause a displacement of the pain, and when the stomach itself is shifted, as by deep inspiration and expiration, there is no accompanying shifting of the pain. In localised affections of the stomach (as ulcer), however varied the position may be from cardiac to pyloric end, the pain in the great majority of cases is referred by the patient to some part of the epigastric region (*see* p. 143).

73. The Character of the Pain.—Although the

stomach is a hollow muscular viscus, severe cramp-like pain from violent peristalsis is of rare occurrence. It will usually be found, in the long run, that the so-called "cramp of the stomach," in which there is pain of great severity and referred to the epigastrium, is due to gall-stone colic. I have watched many patients for years who suffered from these severe attacks, and found that they all turned out to be cases of gall-stone disease. In later years I have had little difficulty in recognising their origin, because of the peculiar distribution of the reflex phenomena in gall-stone disease (*see* p. 154). Violent cramp-like pain may rarely arise in stomach affections, but the pain tends to radiate higher into the chest, and may be into the jaw (vagus stimulation). More frequently the pain of stomach affections is of a dull prolonged boring character. Its position being so definitely situated in a region remote from the seat of the lesion (as in gastric ulcer) shows that it is the outcome of a stimulation of an irritable focus in the spinal cord. The pain is therefore more prolonged, and varies little in intensity. Such a distinction of the character of the pain can usually be made, and seems to account for the persistent boring pains in gastric ulcer and in other conditions. The relation of the pain to the ingestion of food is very variable. In some the introduction of food into the stomach causes immediate pain, or the pain may come on at variable intervals after food. When the pain comes on two or three hours after food, relief may sometimes be obtained from taking more food. No very certain conclusions can be drawn from this relation of pain to the ingestion of food. Attempts have been made to diagnose the position of an ulcer from this

relationship, but there is no ground for such a diagnosis. As a matter of experience the pain in gastric ulcer may come on at any period whatever its situation. The occurrence of the pain one or two hours after the food, with symptoms of peristalsis (as recognised by the wavy character of the pain) and with acrid regurgitations into the œsophagus, is fairly characteristic of one form of dyspepsia, sometimes spoken of as "hyperchlorhydria," where the trouble is supposed to be due to an excessive secretion of hydrochloric acid. This form of indigestion often yields readily to suitable treatment, but it is not infrequently associated with gastric ulcer and gall-stone disease, and this association should be kept in mind.

74. Hyperalgesia.—In addition to the pain other sensory phenomena may arise, chief of which is the hyperalgesia of the skin and deeper structures. The area which becomes hyperalgesic is the epigastric. It may be limited to a small area in the middle, but it is usually diffuse with indefinite borders, extending sometimes as an irregular band round the left side to the spine.

The hyperalgesia may not be present in the skin, but in the muscles, or in the sensitive layer outside the peritoneum. This can be shown by first testing the skin and finding the sensibility normal, then pressing so that the muscle is stimulated; or by pushing the finger between the recti the peritoneal layer may be found sensitive. Of course, in the latter case, one cannot assert that the pain is elicited by this layer alone, for the pressure may affect other structures, but in view of the observations of Ramström this conclusion is justifiable (*see* page 33).

75. Reflexes.—Associated with this hyperalgesia

there is invariably an increase of the reflexes, superficial and viscero-motor. The superficial is demonstrated by the liveliness of the response when the skin is stimulated, the upper part of the right rectus contracting rapidly and powerfully. Not only is the increased reflex activity shown in the response to the stimulation of the skin in the epigastrium, but it is also shown by the greatly extended cutaneous field from which it can be elicited. Normally the reflex of the upper portion of the rectus muscle is obtained from an area limited to the epigastrium, but with an irritable focus in the cord the cutaneous area, stimulation of which will cause a reflex contraction of the upper portion of the rectus, may extend as high as the axilla. The extension of this area follows some peculiar law, as responses cannot be elicited from the whole of the left chest, but only from an area extending in an irregularly shaped band up the side to the axilla.

76. Viscero-motor Reflexes.—The viscero-motor reflex is recognised by a permanent rigidity of the upper division of the left rectus muscle. This may be so slight as to be evident as an increase in the tone of the muscle and detected only on comparison with the other parts of the muscular wall of the abdomen, or it may be hard and resistant. In seeking for this reflex gentle exploration is needed to avoid the production of the superficial reflex.

77. Vomiting.—Vomiting as a symptom of stomach affection is somewhat infrequent and of very variable significance, and the most persistent vomiting may arise reflexly from other organs, as in the persistent vomiting of catarrhal jaundice, pregnancy and brain affections. As a symptom of stomach affections the frequency of the vomiting and

the nature of the material vomited constitute the best evidence. An occasional attack of vomiting may arise from a great many causes. In persistent vomiting, if the reflex vomiting from other organs can be excluded, some inflammatory affection may be recognised, and the possibility of gastric ulcer considered. The response to treatment is an important factor in diagnosis.

Certain characteristics at the time of vomiting give information. The morning sickness of pregnancy and of the alcoholic is very diagnostic. The vomiting, once a day, or every day or two, of large quantities is suggestive of the dilated stomach secondary to pyloric stenosis. The character of the material vomited is also of importance. If the contents of the stomach contain the food that has been taken many hours before, some obstruction to its passage is suggested. The thick viscid mucus vomited is characteristic of a somewhat violent gastritis. The presence of blood (coffee-ground vomit), is characteristic of ulceration. Inquiries should always be made for the presence of "tarry" stools. The vomiting of large quantities, sometimes with brown froth, is characteristic of dilatation of the stomach. Vomiting with a fæcal odour usually indicates obstruction of the bowel. The absence of hydrochloric acid in the vomit suggests the possibility of cancer.

78. Pyrosis and Heart-burn.—The food may regurgitate back into the œsophagus. Sometimes this is normal (merycism), and is of the nature of the return of the cud in ruminants. In certain cases, when the stomach contents become abnormally sour and acrid, strong peristalsis may produce pain with regurgitation of some of the contents into the œsophagus, and thus give rise to the painful burning

sensation described as "heart-burn." This may be accompanied by the return into the mouth of some of the contents of the stomach, sometimes insipid to the taste, sometimes sour and acrid (pyrosis, water-brash). One form of this condition has received the name of hyperchlorhydria, because an excess of hydrochloric acid is present in the stomach contents, and because it can be relieved by alkalies. But this increase in hydrochloric acid is but one of the abnormal manifestations, and excess in its secretion is not necessarily the disease, nor the cause of the symptoms, for the administration of hydrochloric acid relieves the symptoms, and the presence of hydrochloric acid in the œsophagus does not cause heart-burn. There are other acrid substances of unknown nature present which evidently excite the peristalsis of the stomach.

79. Air Suction.—Flatulence is a common complaint with dyspeptics, but true flatulence, *i.e.*, flatulence due to evolution of gases in the stomach, is relatively rare. The vast number of people who suffer from "attacks of wind," and who appear to expel large quantities with a loud noise, owe their attacks to air spasmodically sucked into the œsophagus or into the stomach. These may start with a slight feeling of distension after meals, when the patient endeavours to obtain relief by expelling wind. In this attempt air is unconsciously sucked into the œsophagus, and its noisy expulsion is supposed to be an evidence of air being expelled from the stomach. Sometimes the air is sucked into the stomach, and its expulsion is accompanied by some flatulence that was present in the stomach, and in consequence considerable relief is obtained. Some people when suffering from

pain get a measure of relief by sucking air voluntarily into the stomach and then expelling it.

This air suction occurs most frequently in people of a neurotic temperament, and the attacks may come on when they are put out, worried, or suffering from affections of other organs. When a patient complains of attacks of flatulence coming on suddenly as during sleep, it will often be found that the patient is an air-sucker.

80. Functional Symptoms.—The symptoms that arise from changes in function are available in relatively few cases. Those due to alteration in the secretion are mainly limited to the recognition of an excess of mucus, or an increase or diminution of the amount of free hydrochloric acid in the stomach contents, obtained either from the vomit or by the stomach tube. There are so many individual variations in the amount of gastric juice secreted and in the relative proportion of hydrochloric acid present, that deductions drawn from an examination of the stomach contents must be applied with the greatest caution.

Increase in the amount of hydrochloric acid is indicative of no definite lesion, and the absence of free hydrochloric acid, though suggesting the possibility of cancer, is by no means diagnostic, as it may be absent in a variety of conditions. Save that its absence necessitates the consideration of the question of cancer, it is doubtful if the symptom is of any further importance. Functional derangement of the digestive fluid may be detected by the delay of digestion. This delay is recognised by the retention by the stomach of portions of undigested food, and by observing the time taken to digest a test meal.

Dilatation of the stomach is an evidence of a loss of the function of tonicity in the muscular wall, and can be detected by careful percussion, or by the presence of splashing when the stomach is shaken by succussion, or by tapping over the stomach. The extent of the dilatation can often be made out by distending the stomach with carbonic acid. The simplest method is to give the acid part of a seidlitz powder in solution first, followed by the alkaline. The evolution of the carbonic acid causes a visible swelling in the abdomen due to the distension of the stomach.

The use of the X rays in the examination of the digestive tract has been of the greatest service. By giving a meal containing a large quantity of bismuth the movements of the food can be detected. Observation by this means has shed an unexpected light upon the position and shape of the normal stomach, and shows that the description usually given is quite wrong. In quite healthy people the stomach may be as low as the umbilicus. In fact so variable is the shape and position of the stomach in presumably healthy people that no certain standard is yet recognised. In consequence of this the recognition of abnormal conditions of the stomach by the X rays is mostly limited to cases of very great increase in size.

The retention of portions of food in the stomach for a considerable time affords evidence of the inefficiency of the peristaltic contractions to empty the stomach of its contents. Although dilatation is seen in its most characteristic form in emaciated people with pyloric stenosis, yet it may be of considerable extent where there is no obstruction; and there may be difficulty in deciding whether the

dilatation is secondary to the pyloric stenosis. A long history of stomach trouble with pain, particularly if referred to the lower part of the epigastrium, suggests pyloric stenosis. In rare cases a history of vomiting blood, or of huge liquid vomits at intervals, is also suggestive of pyloric stenosis. Apart from pyloric stenosis dilatation of the stomach is a very common condition, and may be present when there is no symptom pointing to digestive insufficiency. At other times dilatation may be found associated with all kinds of symptoms.

The cause of dilatation is, as I have said, a lack of tonicity in the muscular wall. It is impossible to account for its appearance, and although it may be spoken of as a symptom of "atonic dyspepsia" yet it may be present with no dyspepsia.

81. Structural Symptoms.—Apart from the evidences of dilatation which have been alluded to, the symptoms produced by changes in the organ itself are limited to the detection of tumours in the stomach wall. In the early stages they are impossible to recognise, partly because of the manner in which they occur as a somewhat diffuse thickening of the stomach wall, and partly because of the unyielding contraction of the overlying muscles. It is only when the tumour is in the anterior wall, or has increased to a considerable size, that it can be detected. By that time the patient's condition, if the tumour is malignant, will have suggested the serious nature of the complaint.

Constriction of the stomach, however, may arise as a result of contraction of gastric ulcers (hour-glass contraction). The detection of this condition is a matter of some difficulty, but it may be suspected

when in washing out the stomach a portion of the fluid poured in cannot be drawn off.

82. The Diagnosis of Stomach Affections.—From the foregoing discussion it will be seen that in the vast majority of stomach affections there are few signs that may be considered distinctive of any one complaint. When a diagnosis can at once be made in any given case, the patient has been suffering for a considerable time. As the general practitioner is usually consulted long before a definite physical sign, as a tumour, blood-vomit, or dilatation is apparent, and as the symptoms of ailments from the simplest to the most serious are at first identical, it is necessary to adopt other methods in order to arrive at a diagnosis, such as watching the progress of the affection, its response to treatment, and the general condition of the patient.

As diets are so varied, the personal predilection of the doctor may lead him to assume that the patient's trouble at first is due to some dietetic error. In this he may be right, and it is always best in any given case to start the observation by ordering the patient the simplest and most easily digested form of food. My own practice, in all doubtful cases, is to attend to decayed and deficient teeth, to prescribe a diet in which the food is given in small amounts, the solids dry so as to ensure efficient and thorough mastication, and the fluid mostly in the form of milk, also small in quantity. With people who have to follow their daily work (which is the case with the majority of patients who consult the general practitioner), the food should be taken every two hours. When at work this may be limited to a dry crust, to be thoroughly and slowly masticated.

At other times meat or fish with dry bread or toast may be given, if the patient is able to digest it with comfort. The quantity must be regulated at all times by the suffering of the patient. By this simple process the majority of cases of indigestion, due to error in diet, will be relieved. Speedy relief after such a change of diet, or from some simple remedy, must not be taken as an evidence that the stomach is free from any serious lesion—all that has been done has been to remove the stimulus that was adequate to produce the reflex symptom (pain, hyperalgesia). This is a point on which it is necessary to insist, for many cases of severe stomach disease may be thus temporarily relieved. In such cases the history must be inquired into, and the presence of other symptoms sought for. Persistence of suffering, and of hyperalgesia of the epigastric skin and muscle, with contracted recti, are signs usually indicative of ulceration. When these dietetic changes are followed by no improvement, rest in bed is the next step, and the patient may have to lie many months before improvement sets in. When there is dilatation, washing out the stomach and examination of the contents is of use.

The appearance of symptoms of indigestion in persons over the age of forty years, with wasting, should at once arouse the suspicion of malignant disease. In all cases the appearance of the patient should be studied, and in case of blanching the question of hæmorrhage should be carefully inquired into.

The possibility of gall-stone disease should always be borne in mind in chronic forms of indigestion. In severe suffering the temperament of the patient may aggravate the symptoms, for the

reaction of a slight stomach lesion in a neurotic subject may cause widespread sensory phenomena.

83. Pain in Gastric Ulcer.—As gastric ulcer can frequently be definitely localised, the comparison of the site of the ulcer with the site of pain sheds a light upon the mechanism of visceral pain, and illustrates the practical value of the method of examination. I have watched patients with gastric ulcer continuously for a great number of years, and have had the opportunity of verifying the diagnosis post mortem, or at operation, in a good number. The result of these observations has been to show that, though the actual site of the ulcer had no direct relation to the place where the pain was felt, there was a fairly definite relation explicable by the nervous connection of the parts. In many cases the patient can localise the pain with great definiteness in some limited region, and the skin and deeper tissues may there be hyperalgesic. In such cases I have found that when the ulcer was situated near the cardiac end of the stomach the site of pain and hyperalgesia were in the upper part of the epigastrium, when the ulcer was in the middle of the stomach the site of pain and hyperalgesia were in the mid-epigastrium, and when the ulcer was at the pylorus the pain was felt at the lowest portion of the epigastrium.

To illustrate, not only the justification of this view, but, more important, its practical utility, I will cite some typical instances. I was called into consultation to see a young woman twenty hours after perforation of the stomach had taken place. The patient had suffered for many months from pain after food. She located the site of this pain with great certainty in the upper part of the epigastrium, over

the xiphisternum. I reasoned from this that the perforated ulcer would be near the cardiac end of the stomach. The incision opening the abdominal cavity was, therefore, made as far to the left as possible. On opening the abdomen there was found a large quantity of fluid, and a considerable quantity of flaky lymph covered most of the exposed organs. The stomach was carefully searched, and we found it rather firmly adherent at the cardiac end to the posterior wall of the abdomen. We inspected the whole of the stomach except the adherent part, and there can be no doubt that the adhesions surrounded the ulcer. We resolved not to break down these adhesions, as it would have been impossible to drag this portion of the organ sufficiently far out to enable us to stitch it. The abdomen was very efficiently flushed, the wound stitched up, and the patient made a good recovery.

Another patient I saw in consultation suffered from peritonitis, resulting from perforation of a gastric ulcer. She was a servant girl, twenty years of age. For three years she had suffered at varying times from severe indigestion, and a year ago had vomited a quantity of blood. The pain from which she suffered was situated in the upper part of the epigastrium, just over the xiphoid cartilage (in the shaded area of fig. 9), and was felt through to the back. When admitted to the hospital, the abdomen was hard and tense, the pulse very soft and 160 per minute. The abdomen was extremely tender to the touch; but on closer examination this tenderness was found to be purely cutaneous, the hyperæsthesia extending beyond the limits of the abdomen—over the lower part of the thorax and down over the thighs. In a few days the hyperæsthesia disappeared,

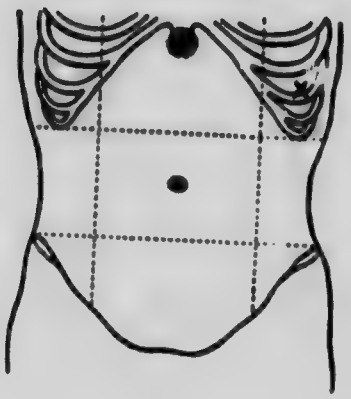


FIG. 9.

The shaded area shows site of pain. × corresponds to the position of the ulcer in the stomach as found at the post-mortem examination.

except in a diffuse, ill-defined area about the epigastrium; the greatest tenderness always being over the upper part of the epigastrium. The patient sunk and died. At the post-mortem examination there was found much matting of the stomach, bowels, and liver in the upper part of the

abdomen by recent soft peritonitic adhesions. The stomach was found perforated by a large ulcer near the cardiac end, its position *in situ* being nearly as far out as the mid-axillary line (indicated by ×, fig. 9). There were two other superficial ulcers in the immediate neighbourhood, but they were nearer the œsophageal opening than the perforation.

A girl, aged fourteen years, who had had pain after food for many months, referred the situation of the pain with great precision to a spot in the middle of the epigastric region (fig. 10). She was suddenly seized with collapse and severe pain over the upper part of the abdomen. There could be no doubt that it was a case of perforation of the stomach. Within eight hours we opened the abdomen, and as I had noted the situation of the pain previous to the rupture, I suggested that the ulcer would probably be found in the middle of the stomach. The incision was therefore made well to the left of the middle line. The perforation was readily met with in the middle of the stomach on the lesser curvature, in a position corresponding to the + in fig. 10, stitched up, and the patient made an excellent recovery.

Female, æt. 32, for ten years had frequently vomited large quantities of blood, and suffered from severe pain in the epigastrium. The pain was always felt with the greatest intensity at the lower part of the epigastrium, corresponding to the area shaded in fig. 11. From this region the pain would frequently strike round the left side, and be felt severely over the sixth and seventh dorsal vertebræ. The painful area in the epigastrium was often extremely sensitive to the touch, and the cutaneous hyperæsthesia sometimes extended as a broad band round the left side. The last note I made about the

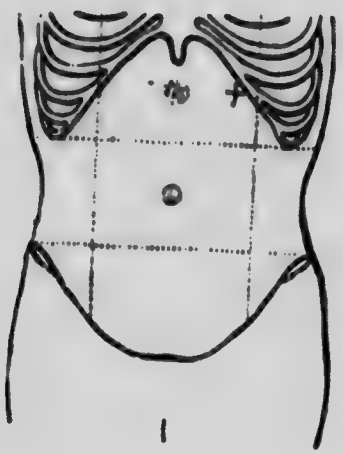


FIG. 10.

The shaded area shows the site of pain, and the + the position of the gastric ulcer as found at the operation.

patient was on 1st April, 1897, to the effect that the patient "vomited a large quantity of blood yesterday. The pain is felt very severely midway between the xiphoid sternum and the umbilicus, striking round towards the left side"; and then follows a diagram noting the area, as marked in fig. 11.

In treating this patient, at an early date, a blister the size of a florin had been applied over the painful area in the epigastrium. So much relief was obtained when the cutaneous surface was raw, that Savin ointment was used to keep the wound from healing, until all symptoms of pain had disappeared. During the last five years of her life (she died of phthisis) the patient had been in the habit, from time to time, of applying the blister herself whenever there was a recurrence of the pain. At the post-mortem examination the effects of a recent blister were still evident, as a superficial erosion occupying the lower part of the epigastrium, corresponding exactly with the area shaded in fig. 11.

The patient died suddenly on 7th July. At the post-mortem examination held next day, an ulcer, 1 in. in diameter, with slightly thickened edges, was found situated partly in the stomach and partly in the pylorus. I requested my colleague, Dr. Brown, to note exactly what position the ulcer occupied in relation to the external body wall, and he, carefully noting the situation, indicated an area corresponding to × in fig. 11.

Another case had been under my care for ten years for repeated attacks of epigastric pain. The pain in this case was very constant, unless during three pregnancies when she was quite free. She consulted an eminent surgeon who wrote to me stating that the patient had an ulcer in the middle of the stomach and on the posterior wall, and he recommended an operation for her relief. I re-examined the patient and made the following note in my diary: that, inasmuch as the pain is situated at the lowest part of the epigastric region, and as there is also here a limited area of tenderness of the skin, the ulcer

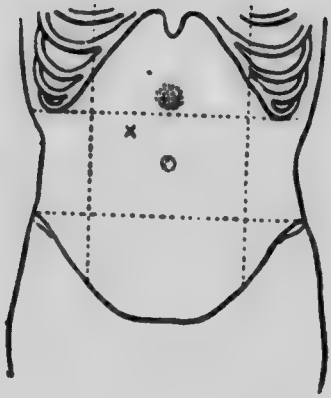


FIG. 11.

The shaded area shows the site of pain, × the site occupied by the ulcer at the pyloric orifice of the stomach as found at the post-mortem examination.

should be found at the pyloric orifice. This latter view was verified at the operation subsequently performed.

A patient, whom I had attended for twelve years with mitral stenosis, and who died in 1907, aged thirty-six, suffered severely from gastric ulcer in 1899, so

that she had to be kept in bed for two months, and fed with the greatest care. The pain gradually abated, but kept recurring at intervals. It was always referred to the epigastrium, but radiated widely. Thus I made this note on May 13th, 1903: "Has severe pain starting at the shaded area (as in fig. 11) and passes round to the left side. There is no tenderness of the skin or muscles, and no vomiting. Stomach resonance as low as the umbilicus." She died in February, 1907, from her heart affection, and at the post-mortem examination an ulcer was found at the pyloric end of the stomach—at some distance from the epigastrium. The relative positions of the site of pain and of the ulcer were the same as shown in fig. 11.

CHAPTER XIV.

THE LIVER, GALL BLADDER AND DUCTS.

84. *Nerve Supply.*
85. *Reflex Symptoms in Gall-stone disease.*
86. *Gastric Symptoms in Gall-stone disease.*
87. *The result of Reflex Symptoms.*
88. *Functional Symptoms in Gall-stone disease.*
89. *Structural Symptoms in Gall-stone disease.*
90. *Fever in Gall-stone disease.*
91. *Nature of Reflex Symptoms in affections of the Liver.*
92. *Functional Symptoms in affections of the Liver.*
93. *Structural Symptoms in affections of the Liver.*

84. Nerve Supply.—The symptoms associated with the liver, gall-bladder, and ducts, in many cases resemble those of the stomach so closely that there is often a difficulty in differentiating the one from the other. This will be understood when it is borne in mind that developmentally the liver and its appendages are an outgrowth of the digestive tube immediately below the stomach. The region in the cord from which the nerve supply passes is at, and immediately below, the region of the stomach supply, from the seventh to the ninth thoracic; so that with severe stimulation the irritable focus in the cord invades the nerve supply of the stomach. As in stomach affections the reflex phenomena appear

in the epigastrium, but in gall-bladder affections the hyperalgesia is most common on the right side, and the upper part of the right rectus muscle becomes contracted. The symptoms also tend to spread to the right side and lower down in the abdominal wall. In addition to the thoracic nerve supply the liver and gall-bladder and ducts are also supplied by the phrenic nerve (fourth and fifth cervical) and by the vagus.

85. Reflex Symptoms in Gall-stone disease.—The reflex symptoms in affections of the liver itself are often not very distinctive, while those of the gall-bladder and ducts are frequently violent and very characteristic. This difference is due to the fact that the former is a glandular structure, while the latter contain non-striped muscular fibres which, we have seen, may provoke the most violent sensory phenomena.

The pain in gall-stone disease varies much in severity. It may begin with a sense of uneasiness in the epigastrium, or over the lower ribs on the right side. A small area of cutaneous or muscular hyperalgesia may be detected somewhere in the region in which the pain is felt, and also in the upper portion of the right rectus. This muscle may be more or less contracted. These symptoms may be slight and variable, and present for months or years, or the patient may be seized suddenly with violent pain, with or without these preliminary symptoms. The pain in the majority of cases of gall-stone colic is situated in the middle line, about the lower part of the epigastrium. It may come on gradually and remain for an indefinite period, sometimes varying slightly in intensity. From this place it tends to spread to the right side, and may be felt



FIG. 12.

The shaded area shows the region of cutaneous hyperalgesia after an attack of gall-stone colic. The + is the position of a tender point in many cases in gall-stone disease, and is over the place where a twig of the ninth thoracic nerve passes out of the rectus abdominis muscle.

with great severity below the edges of the ribs. Sometimes it may extend round to the back, and be felt most severely over the ninth and tenth ribs. In rare cases the pain may only be felt in the back.

The pain, intermitting slightly, may remain for many hours, unless relieved by a sedative. Frequently after the subsidence of the pain the skin and muscles of the upper part of the right side

of the abdomen become very tender to touch, and the muscles hard and contracted. In fig. 12 the area of cutaneous hyperalgesia is shown in the patient in whom I first discovered the presence of hyperalgesia in 1891.

In a great many cases, after the subsidence of the attack, the hyperalgesia may persist for several weeks, and, during this period, severe attacks of pain are very liable to be provoked, so that the patient is scarcely able to move about.

In a small percentage of cases pain, sometimes of great severity, is felt on the top of the right shoulder, striking down the outside of the arm. It is very necessary to recognise the relationship between pain in this region and gall-stones. I have known patients in whom there was this pain in the shoulder and in the arm treated for years for "neuritis," and the passage of a gall-stone has been followed at once by relief. In many cases this shoulder pain is not very severe, and the patient may not refer to it. If, however, inquiry be made, the patients frequently declare that they have had pain in the right shoulder, which they thought was "rheumatic." When this shoulder pain is severe and the chief complaint, if due to gall-stone disease a careful search will reveal evidences in the upper part of the abdomen, in the hyperalgesia of the skin, in the contraction of the muscles, and in the history of the patient which leaves little doubt as to the cause of the shoulder pain.

86. Gastric Symptoms in Gall-stone disease.—In persistent "dyspepsia" and heart-burn, the question of gall-stones should always be considered. I have already referred to the association of pain on the ingestion of food into the stomach with gall-

stone disease. One frequently sees patients with a history of "acute gastritis" in which the symptoms were described as attacks of severe pain in "the pit of the stomach," or "cramp of the stomach," followed by a period when ingestion of food caused pain. Such a history will, in the majority of cases, be found really to have been due to gall-stone colic, with the subsequent condition of hyperalgesia associated with an irritable focus in the cord.

Nausea and vomiting are frequent accompaniments of gall-stone colic, and their occurrence with the pain in the "pit of the stomach" might seem to confirm the conclusion that the case is one of "gastritis," or "cramp of the stomach."

87. The result of Reflex Symptoms.—When we come to consider the effect of this hyperalgesia, contracted muscles and exalted reflexes, we get a picture that is often very misleading. After the attacks of severe pain have subsided the patient may be unable to breathe freely, each inspiration being checked, as it is in pleurisy, by spasm of the intercostal muscles, and severe pain may be felt over the lower ribs on the right side. Such symptoms are sometimes mistaken for pleurisy. If a careful examination be made, it can be demonstrated that there is an extensive field of hyperalgesia, extending up into the chest and implicating the intercostal muscles. The exercise of hyperalgesic muscles is always limited on account of their increased tone, and the tonic contraction tends to increase with their continued action. It is for this reason that patients with gall-stone and persistent hyperalgesia of the abdominal muscles are comparatively at ease when at rest. On moving about there gradually comes on a feeling of pain and dragging round the

abdomen, and the patient is unable to "stretch" himself freely. This is simply due to the fact that the exercise of the hyperalgesic muscles has increased their tonic contraction and their sensitiveness, so that their exercise is painful and the extent of their movement becomes greatly limited.

88. Functional Symptoms in Gall-stone disease.—It is in only a small proportion of cases that jaundice is present in gall-stone disease. If the stone is situated in the common duct, or can cause pressure on the common duct, so as to obstruct the channel, then jaundice arises. When the jaundice is so slight that it is difficult to determine whether it may not be due to a sallow complexion, a careful inspection of the sclerotic may reveal a faint tinge. It may be necessary in cases of doubt to examine the urine or blood for minute traces.

89. Structural Symptoms in Gall-stone disease.—It is only in very rare cases that gall-stones can be detected in the gall-bladder. It can only be done when the stones are so numerous as to cause a tumour, or when the stones cause the gall-bladder to become distended with fluid. This can only happen at a late stage in the disease, and when all the associated reflex phenomena have disappeared, for the presence of hyperalgesia means also the presence of a lively muscular reflex, which effectually prevents the hand reaching the gall-bladder. When the abdominal muscles are lax the distended gall-bladder may be felt as a tumour, and, in rare instances, the stones have been palpated. The liver is sometimes said to "enlarge and become tender." As, however, the writers who describe this have not appreciated the association of this so-called "tender liver" with contracted muscles, this observation

needs to be verified. For my part I have never been able to satisfy myself as to a slight liver enlargement when there is hyperalgesia and contracted muscles. The muscles are so tender on pressure and contract so firmly that it is impossible to palpate the liver; the percussion note also becomes altered with a contracted muscle.

90. Fever in Gall-stone disease.—In the great majority of cases of gall-stone disease there is no fever, except it may be a slight rise at the time of an attack of colic. In some cases there is an associated inflammation of the gall-ducts, and, as a consequence, febrile attacks may occur of a very characteristic type. These are generally very sudden in their onset and in their subsidence. The patient begins to feel chilly and shivery, and when his temperature is taken it will be found to be considerably raised—101-104. He may have rigors. In the course of one to three days the temperature returns to normal.

In more advanced stages of cholangitis the temperature may remain continuously above normal with frequent exacerbations. With the formation of pus the temperature usually remains continuously high.

In all obscure cases of intermittent temperature the possibility of gall-stones should be considered. Except malaria there is no disease which gives such characteristic febrile attacks. In many cases a slight jaundice can be detected.

91. Nature of Reflex Symptoms in affections of the Liver.—I have dealt fully with the reflex symptoms in gall-stone disease, because in this complaint they are seen in their most striking form. In disease of the liver the same areas may be

affected though the symptoms are less violent. As I have pointed out, it is doubtful if the affections of the parenchyma of an organ ever give rise to pain, unless the fibrous covering is affected or stretched. As a rule in liver affections there is little pain, unless this hyperalgesia of the external body wall and the tender structures are stimulated, as in exercise of the muscles, when pain will be felt in the muscles so exercised. This is well seen in cases of rapid increase in the size of the liver from heart failure, when the capsule is stretched, and when, if the patient moves about, there is considerable pain felt in the muscles over the liver, in front and round to the back. The enlargement of the liver due to heart failure offers an excellent opportunity for the study of the reflex symptoms of liver affections. These symptoms are seen most strikingly when the heart failure sets in with some rapidity, as when the heart's contraction in mitral disease takes on the "nodal rhythm"; that is to say, when suddenly the contraction of the heart ceases to start at the normal place, but auricle and ventricle contract together. In certain cases of paroxysmal tachycardia this abnormal rhythm is suddenly developed, and in the course of a few hours the heart dilates and the liver becomes very considerably enlarged. If the patient keeps at his work, feeling weak and breathless, severe pain is suffered from across the back and round in front over the liver. If he be examined a patch of cutaneous hyperalgesia may be found embracing a considerable portion of the upper part of the right side of the abdomen. The muscles under the ribs in front will be found hyperalgesic and contracted, and the erector spinæ muscles at the level of the eighth to twelfth ribs will also be found

hyperalgesic (*see* fig. 16, page 227). If the heart should suddenly return to the normal, the liver enlargement subsides in a few hours, and the hyperalgesia disappears. If, however, the abnormal rhythm persists, then with rest in bed the hyperalgesia gradually diminishes until one can palpate the liver through the abdominal wall, and even take tracings from the enlarged and pulsating liver.

In enlargement of the liver due to other causes, as hypertrophic cirrhosis, cancer, chronic and subacute abscess, the reflex symptoms are of the same nature but less acute. I have no experience of acute inflammatory affections of the liver, so cannot tell the nature of the symptoms present.

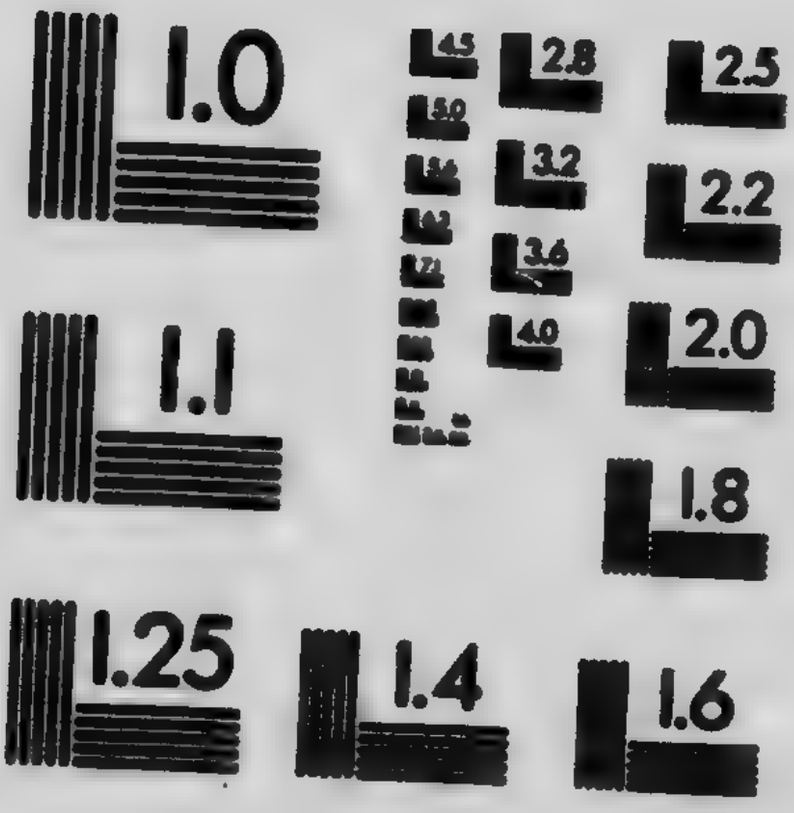
Severe and persistent vomiting may arise in liver affections. In the early stages of "catarrhal jaundice," before the jaundice appears, the patient may suffer from the most violent and persistent attacks of vomiting, and the cause may remain unsuspected till the jaundice appears.

92. Functional Symptoms in affections of the Liver.—Jaundice is, of course, the most striking, and needs no further description. In all cases of sallow or dirty gray complexion, the liver should be carefully examined. When chronic liver affections produce jaundice, or alter the complexion, there is generally present also a considerable degree of wasting. This wasting, with an enlarged liver and a faint jaundice tinge, is very suggestive of malignancy. In some cases of chronic heart failure there may be wasting, enlarged liver, jaundice, slight or severe, which simulate malignancy so closely that a mistaken diagnosis is not uncommon. If the heart be examined the evidences of heart disease are always



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so marked that no difficulty should be met in recognising the real nature of the liver trouble.

93. Structural Symptoms in affections of the Liver.—Normally the upper margin of the liver dullness corresponds to a transverse line drawn at the level of the junction of the sternum and the xiphi-sternum. The lower edge corresponds in the nipple line to the edges of the ribs.

Organic symptoms may be recognised as an enlargement of the organ, or a diminution of its size. When there is much muscular hyperalgesia it is often difficult to define the limits of the organ. In the absence of this, little difficulty is found in detecting the extent of the liver enlargement. This is better done by palpation than by percussion, as a distended bowel may communicate a resonant note, particularly with enlargement of the left lobe. In enlargement of the organ from heart failure the organ can sometimes be felt to pulsate. This is perceived by putting the left hand behind and pressing up the liver, while the right hand is laid over the liver, which will be found to heave gently with each cardiac revolution. The extent to which the liver may enlarge is very great, and its lower margin may extend as low as the brim of the pelvis.

The surface of the enlarged liver may be nodular, as in cancer and cirrhosis. In the great majority of cases the enlargement of the liver is downwards, but in hydatids of the liver, the cyst being on the upper margin, the liver dullness may extend upwards to the third rib. Percussion gives rise to the characteristic thrill due to vibration set up in the fluid contents of the cyst.

The liver may be pushed down by abnormal conditions in the chest, as in emphysema or pleural

effusions, or it may be displaced downwards on account of laxity of its ligaments and of the abdominal muscles (hepatoptosis).

It may be dragged up into the chest, as in the retraction that follows the absorption of a long-standing pleuritic effusion.

Diminution of the size of the liver may occur, as in atrophic cirrhosis. Here it is the lower border that recedes.

CHAPTER XV.

THE GREAT AND SMALL INTESTINE.

94. *Difficulties in Diagnosis.*
95. *Pain.*
96. *Appendicitis.*
97. *Affections of the Anus and Perineum.*
98. *Perineal Reflex.*
99. *Functional Symptoms.*
100. *Structural Symptoms.*

94. Difficulties in Diagnosis.—The difficulties in diagnosis of affections of the bowels are very great. The great length of the tube, with its coils confusedly mixed so that there is no safe guide to the locality of many portions, the continual shifting of each portion with the peristalsis of the gut, and our very imperfect knowledge of many of its functions, all combine to render diagnosis of bowel affections a matter of great uncertainty. There is a misconception, almost universal, as to the position and form of the great intestine, many pictures of this portion of the gut showing it as passing in swelling folds up the right side, across the upper part of the abdomen, and down the left side from the splenic flexure to the rectum. It is further stated that the position of this gut can be made out by percussion. With the exception of the cæcum, which is more or less fixed in its place, and usually distended with gas, no part of the gut can be accurately

mapped out. To begin with, it is doubtful if the descending colon is ever distended in the manner shown in the pictures. When empty of fæces it lies behind coils of small intestine, a contracted narrow tube. Dr. Her' study of the movements of the bowel after h ath meals, shows that the transverse colon va.ies extraordinarily in its position in different people. The ready distension of any portion of the small intestine renders attempts to differentiate the particular portion distended a matter of the greatest uncertainty.

A similar confusion exists in regard to the localisation of pain. The sensation of pain is frequently so diffuse and generalised that no clear indication can be obtained in many cases in regard to its exact site. When severe pain arises from peristalsis the situation can often be localised with a certain amount of precision, but here the recollections of the patient are extremely unreliable. I have frequently been struck by the discrepancy between the patient's account of the position of the pain described from memory, and the actual position to which he refers the pain when asked to locate it while suffering from an attack of pain. For this reason the account given by the patient must be taken with great reserve.

To a certain extent the confusion also depends on the shifting of the site of pain. The cause of pain in the intestine is often due to strong peristalsis, and in disease the peristalsis often does not appear at the site of the lesion, but at some distance above it, whence it gradually descends, and as the wave passes over coil after coil the position of the pain shifts likewise. Peristalsis may be stimulated below the disease, as, for instance, when the irritating

secretion from an inflamed portion of the gut causes painful peristalsis as it is conveyed along the bowel.

On account of these and other reasons the diagnosis of bowel conditions is often extremely unsatisfactory, though the recognition of the difficulties should lead to a more careful scrutiny of the symptom in each individual case. In the matter of pain, the patient should, if possible, be interrogated at the time he is suffering, and the position of the pain localised as he feels it. If this is impossible, then he should be asked to pay strict attention when it recurs to note the exact site of the onset and the subsequent radiation of the pain.

95. Pain.—I have already pointed out that the pain from peristalsis of the bowel is usually limited to the middle line of the body. In order to recognise the area in which the pain from any given portion of the bowel may arise, I have taken careful observations in cases of obstruction of the bowel as one was frequently able to demonstrate the site of the lesion by operation or post-mortem examination. It is well known that the bowel below the obstruction ceases to contract and lies inert. On the other hand, the bowel above the point of obstruction is usually stimulated to violent peristalsis in the attempt to overcome the obstruction. In consequence of this violent peristalsis severe colic-like pains are set up. Careful observation of the patient during an attack will reveal the fact that the pain starts high up in the abdomen, passes gradually lower and lower, till it reaches a climax at some definite part; then it ceases and does not descend lower. If when the pain stops this part be noted, the situation of the obstruction can be localised within certain limits. Unfortunately the limits are still wide; nevertheless, the

information is extremely useful. If we take the usual divisions of the areas of the abdomen as in fig. 8, page 113, it will be found that the peristalsis of the small intestine gives rise to pain limited to the umbilical region, never descending below the area. The cases in which I have specially studied the pains due to obstruction of the small intestine have been in strangulated hernias, and I have had abundant opportunities in operating to verify the situation of the obstruction. This localisation of the pain in the umbilical region is supported by the experience acquired in the case of peristalsis, with the intestine exposed, cited on page 37. An attempt has been made to find out whether the localisation might not be more exact, by noting the level of the pain, but the sensation is evidently too diffuse to permit of such exact localisation. One would naturally expect to find a distinct relationship between the level of the pain and the position of the obstruction, but owing to this diffusion I failed to satisfy myself in any given case of the exact limits of the pain. The pain, when very severe just at the lowest limits, also extends widely across the abdomen at the same level. In many cases a diffuse area of hyperalgesia of the skin and muscles may be detected, but it has been of such a vague character that I have not found it of much value as a diagnostic factor.

In obstruction of the large intestine the pain due to the peristalsis descends to the hypogastric region (fig. 8, page 113), and here certain limited deductions can be drawn from the level at which the pain stops. The cases I have studied have been patients with obstruction at the splenic flexure, or at the sigmoid flexure, and cases of hard masses of fæces retained

in the rectum. In the obstruction at the splenic flexure the pain did not descend below the middle of the hypogastric area, while the pain due to peristalsis below the splenic flexure was felt about, and below, the middle of the hypogastric area. I have observed a number of cases with fæcal masses in the rectum, too large and hard for their expulsion by the anus. In these cases the situation of the pain and straining efforts seemed identical with the pains and straining during labour. This agrees with what has already been said about the situation of pain in diarrhœa and with distending enemata immediately before the expulsion of the fluid contents of the rectum.

In many people scybalous masses may lie in different parts of the bowel, and their presence may set up, after a time, violent peristalsis, in some cases accompanied by diarrhœa. Once the violent peristalsis begins it does not subside until the scybalæ are shifted. The people in whom I have observed this most frequently have been young women who have neglected their bowels. The pains are very severe, and the motions will often contain grayish hard lumps. After the bowels have been voided a large area of hyperalgesia and muscular contraction over the abdominal wall is left. This tenderness and hardness and the history of colic-like pains give rise to many wrong diagnoses, the principal error being to attribute the symptoms to peritonitis.

96. Appendicitis.—The nature of the symptoms in appendicitis has already been indicated on page 40. From the study of the case given there it will be seen that the symptoms are entirely reflex. In every case there are features peculiar to the individual, so that great variations as to the amount of pain, extent of hyperalgesia and muscular con-

traction are met with. But the nature of the symptoms and their distribution and mechanism of production are sufficiently indicated in the illustrative case given on page 39 to make clear the principles underlying the most salient symptoms of appendicitis.

There are a few symptoms present in exceptional cases that need a passing notice. The nature of the attacks of "appendicular colic" are to me very obscure. In some cases the pains have been so distinctly referred to the umbilical region that I have considered the question whether the intestine above the inflamed appendix may not have been stimulated to violent peristalsis. On the other hand the appendix wall itself contains a muscle coat, and the contents are frequently confined by blocking of the passage, so it may perhaps be surmised that the colic arises from a spasm of the muscle coat. The reference of the pain to the middle line would be in accordance with the experience that peristalsis of any portion of the digestive tube causes pain in the middle line, and parts that have developed from the tube, as the gall-ducts and appendix, follow the same law.

I cannot satisfactorily account for the predominant symptoms from the appendix being so distinctly one-sided, seeing that it is developmentally a portion of the digestive tube. But it is interesting to note that as in the case of the gall-bladder and ducts, and even of the heart, though the most severe pains may be situated across the middle line, the radiations and persistence of the phenomena are one-sided.

In extension of the inflammation in appendicitis other structures become involved, and these then give rise to the symptoms peculiar to them. When the inflammation affects the parietal perito-

neum, and adhesions form with it, these symptoms will be found characteristic of peritoneal adhesions, as pain and tenderness over the part (*see* page 193). This fact may account for many of those aberrant symptoms in appendicitis, as when it is situated in the pelvis and adherent to adjacent parts.

97. Affections of the Anus and Perineum.—A somewhat complicated series of symptoms arise in affections about the anus, in consequence of the nervous distribution passing gradually from the autonomic to the cerebro-spinal system. As at the junction of other mucous and cutaneous surfaces the sensibility becomes profoundly modified, and there is a transition area where certain forms of cutaneous sensibility, such as pain, become more acute. This difference in sensibility is well seen in the case of piles, for so long as the pile does not encroach upon the tissues supplied by the cerebro-spinal nerves, no direct pain is felt, whereas pain of the most distressing character is felt when the pile encroaches on the mucous membrane supplied by the cerebro-spinal sensory nerves. Pain, however, may be felt from an internal pile, and it is then referred to the back, over the upper part of the sacrum. I have seen much relief afforded from this pain by free hæmorrhage from an internal pile. This referred pain is sometimes extremely distressing in cases of ulceration within the rectum, especially after the bowels are moved. When the ulceration or fissure involves the sensitive marginal mucous membrane, the pain becomes at times agonising and prolonged, and is felt in an ill-defined area all around the anus and over the sacrum.

There is an intimate relationship between this region and the bladder, irritation at the anus pro-

ducing frequent micturition, and sometimes spasm of the sphincter vesicæ. This reflex is well seen in women where the perineum has been torn at the birth of a child and afterwards stitched up, retention of urine being a frequent result. This reflex is probably limited to the skin of the perineum, as if care be taken in stitching the perineum not to include the skin in the stitches retention of urine is less likely to occur. The skin supply for this region is from the lower sacral nerves, and the nerve supply for the sphincter vesicæ is from the autonomic sacral nerves—that is, from the same region of the cord.

98. Perineal Reflex.—A curious connection exists between the perineum and the respiratory and other centres. This is seen particularly well in parturition, where, when the child's head presses on the perineum, the contraction of the uterus is sometimes greatly stimulated, and the mother is compelled to "bear down" with uncontrollable energy. In patients lightly under chloroform the traction made by the forceps when the head reaches the perineum sometimes causes the patient to breathe in a deep and laboured fashion. Apart from its scientific interest this latter reflex has to be borne in mind in the administration of chloroform, as by the deep respiratory movements a greater amount of chloroform may be taken than is desirable.

99. Functional Symptoms.—Our knowledge of the symptoms arising directly from abnormal functions of the digestive tube is limited to the condition of the fæcal evacuations. These again must be studied in association with other phenomena, as pain, fever, distension of the abdomen. It is scarcely

necessary to insist on the systematic examination of the fæces by the physician himself in all abdominal cases, and the patient should be instructed to observe for himself the character of the dejecta. The character of the normal stool is fairly constant, soft and moulded, yellowish-brown in the adult, pale whitish yellow in children and the milk-fed. The colour may vary with the food and with drugs. The absence of bile gives the characteristic pale drab-coloured stools. There may be an admixture of the stool with abnormal contents from the intestinal tract, as blood, mucus and pus. Blood from near the anus, as in piles, is usually unmixed with the fæces, either free or staining the fæcal mass. When its origin is higher up it becomes mixed with the food, and undergoing certain chemical changes, becomes black and "tarry" looking. The character of the mucus in the stools may give some idea as to its source; small jelly-like masses accompany the diarrhœa from an inflamed swollen gut, shreds or membrane-like pieces are seen in affections of the colon and rectum. Other abnormal constituents may be present as undigested food, gall-stones, intestinal sand.

The character of certain stools is fairly typical, as the diarrhœic, with hard scybalous masses, indicating that scybalæ are lodged in some part of the digestive tract, and setting up irritation; the "pea-soup" stools of typhoid fever and of pneumonia; the "rice water" stools of cholera; the "frothy stools" of infantile diarrhœa. The shape of the stool may be modified by its passing through a constricted passage near the anus. The recognition of obstruction, partial or complete, need not be insisted upon.

100. Structural Symptoms.—Symptoms due to changes in the bowels are very often difficult to make out, owing to the mobility of these organs, and the ease with which they can become distended with flatus. Except the cæcum and a small portion of the ascending colon and the rectum, there is no part in which changes can be with certainty located on account of shifting and distension of the intestinal coils. In addition to this, tumours and thickenings in any part of the abdomen so readily convey the tympanitic note from the bowel that percussion is seldom of much use in detecting these when they are in the walls of the bowel. A further complication arises when small portions of the muscles of the abdominal wall become hard and contracted (*see* page 68). Manifest changes in the bowels should always be considered with reference to the reflex phenomena already described.

CHAPTER XVI.

AFFECTIONS OF THE URINARY SYSTEM.

101. *Symptoms of Affections of the Kidney.*
102. *Symptoms of Affections of the Pelvis of the Kidney and Ureter.*
103. *Symptoms of Affections of the Bladder.*

101. Symptoms of Affections of the Kidney.—As in the affections of other glandular organs, there are practically no sensory symptoms evoked by disease of the kidney structure. Backache is sometimes put down as present in inflammation of the kidney, but considering how frequent backache is, some doubt is entertained whether the kidney is the cause. For a great many years I have carefully inquired into the symptoms in all sorts of cases of albuminuria, acute and chronic, and I could find no evidence of pain of any form referable to the kidney trouble. All the symptoms of kidney disease (apart from alteration in the size of the organ) are found in the chemical examination of the urine, in the frequent micturition, or as the result of its impaired secretion on other organs and systems (vomiting, headache, convulsions, changes in the cardio-vascular system, dropsy).

Functional Symptoms.—In the routine examination of all cases inquiry should be made into the question whether the patient has to get up at

night to pass urine, and, if such is the case, the urine should be examined for albumen or sugar. The presence of albumen should lead to the careful examination of other systems, particularly the heart and blood vessels, because it is the effect of the impaired kidney function on these that offers the best guide as to the importance of the albuminuria. It must be borne in mind that the presence of albumen is not in itself a matter of moment. It only indicates that albumen is passing through the secretory cells, and long experience has taught that when this happens there is an injury to these cells which prevents the elimination of other matters, which, being retained in the blood, have a deteriorating influence on other organs. It is for this reason that the significance of the kidney affection is often determined by the symptoms in other organs and tissues.

Structural Symptoms.—It is only when there is a considerable increase in the size of the kidney that we can detect its presence clinically with assurance. And even then the subject has to be of a somewhat spare habit. Normally we recognise a certain fullness under the lower ribs in either flank, which rather indicates its presence than gives a clue to its size. It is the relative greater fullness on one side that leads to the recognition of the increase in the size of this organ, and the absence of this fullness which leads to the suspicion of a displaced kidney. The nature of the enlargement in any given case is surmised from the presence of other symptoms, as pus or tubercle bacilli in the urine, the cancerous cachexia, etc.

Movable Kidney.—The careful palpation of the abdominal cavity with the walls relaxed may reveal a movable kidney. It is often present

without symptoms, but its presence may be associated with a good deal of vague, indefinite pain, dilatation of the stomach, and more or less nervous disturbance of a "neurasthenic" kind. Obscure attacks of vague pains, nausea and collapse have been ascribed to a movable kidney, and it is well to bear this in mind, for such attacks may be attributed to appendicitis or other intestinal lesion, or to renal colic.

102. Symptoms of Affections of the Pelvis of the Kidney and Ureter.—*Nerve Supply of the Ureter.*—The efferent nerves supplying the pelvis of the kidney and the ureter come from the inferior mesenteric, spermatic and hypogastric plexuses. The level at which these nerves leave the cord can be inferred from the study of the nerves implicated in the reflex phenomena in cases of renal calculus. From this study the nerves passing from the pelvis of the kidney and the ureter can be inferred to reach the spinal cord at the level of the lower thoracic and upper lumbar nerves. The distribution of the pain and the stimulation of the muscles to contraction, in a case of renal colic, such as that described on page 41, gives a clue to the cerebro-spinal nerves reflexly stimulated by the sympathetic nerves from the pelvis of the kidney and the ureter. The pain arising in the back above the crest of the ilium, passing round the front and slanting down into the testicle, as in the shaded area of fig. 13, page 177, traverses the fields of distribution of several spinal nerves from the eleventh thoracic to the second lumbar. In like manner the contraction of the muscles that accompany the pain gives a clue to the motor cerebro-spinal nerves that have been stimulated. In the

case described on page 41 contraction of the flat muscles over the iliac fossa (the external and internal obliques, and the transversalis abdominis) was produced, the lower portion of these muscles being supplied by the lower thoracic nerves. The contraction of the cremaster muscle, which is often such a distinct feature in cases of renal colic, implies a stimulation reaching the spinal cord at the level of the first and second lumbar nerves. It is interesting to note that a portion of the fibres of the cremaster are continuous with the internal oblique, and both of these muscles contract in renal colic. The genital branch of the genito-crural nerve contains the motor nerve to the cremaster muscle, and also the sensory nerve to the tunica vaginalis, which latter becomes so hyperæsthetic in renal colic when the pain "shoots into the testicle," and it is manifest that it is to the peripheral distribution of this nerve that the pain is referred. It is to be remembered that the scrotal covering of the testicle is supplied by the sacral nerves, and the skin of the scrotum is never affected in renal colic.

Non-striped muscle enters into the structure of the pelvis of the kidney and of the ureter, and in consequence we have the reflex symptoms developed to a very marked and characteristic extent. While any circumstances that can arouse the severe contraction of this muscle seem to provoke the pain and attendant phenomena, the presence of a renal calculus is, in the great majority of cases, the immediate cause. The following description, while referring to renal calculi, also applies to other causes, as pus or tubercular ulceration, which may set up a painful contraction.

The position of the pain, its characteristic

radiation, and the attendant muscular contraction, have been referred to and illustrated by the case described on page 41. The place where the pain starts is of very great importance as giving an idea of the approximate site of the stone. It must be remembered that the gradual shifting of the pain from the back round to the front and down to the groin, is not an indication that the stone itself is gradually being shifted and driven down the ureter. Nor must it be imagined that because the distribution of the pain has a vague resemblance to our notion of the position of the ureter that the pain is felt "along the ureter." The pain in its radiation is passing along some path in the spinal cord, and thereby affects the cord centres of the nerves distributed to the body wall in the area shaded in fig. 13. Doubtless the peculiar path is directly associated with the nerve supply of the pelvis of the kidney and of the ureter, and as each part passes into peristalsis a definite portion of the cord receives a corresponding stimulus, just as happens in the case of the peristalsis of the bowel.

Bearing this in mind, it will be seen that when the pain keeps recurring and starting from the same place the stone is stationary, and its presence stimulates a peristaltic contraction. Hence when we find repeated attacks starting at the back we may safely infer that the stone is lodged in or near the pelvis of the kidney. There is some doubt whether a stone in the kidney surrounded by glandular tissues and not protruding into the pelvis can ever arouse the pain characteristic of renal calculus, for it seems that contraction of muscle is the cause of the pain, and the calculus acts as a stimulus to the contraction.

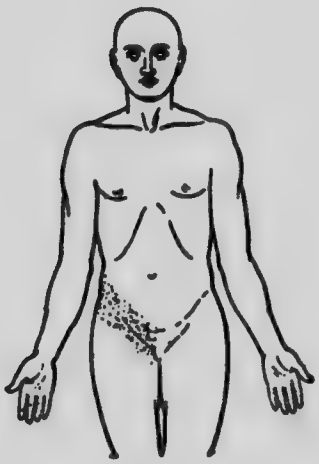


FIG. 13.

The shaded area shows the distribution of the cutaneous hyperalgesia after an attack of renal colic. The band traverses portions of the fields of distribution of the eleventh and twelfth thoracic nerves and of the first lumbar. The tunica vaginalis and the lower portion of the left abdominal muscles were also hyperalgesic.

The explanation of the locality of the pain is that the spinal centres of some fibres of the eleventh thoracic nerve which are distributed in the back are first stimulated, that as the peristaltic wave passes down it sends stimuli to other centres of the eleventh and twelfth nerves whose fibres are dis-

tributed in the area shaded in fig. 13, and later to the genital branch of the genito-crural nerve which is distributed to the tunica vaginalis; hence the pain which shoots into the testicle and the tenderness of the testicle, or rather of the tunica vaginalis, after an attack of renal colic.

In a number of cases the stone seems to stick on its way down the ureter, and the pains then start at a lower level. One may sometimes find a patient with a history of attacks of pain starting in the back, then after a time starting somewhere in the front of the abdomen; then they have ceased, and the symptoms of irritation of the bladder have appeared for a period, followed by the expulsion of a calculus and complete relief.

I am disposed to think that in these cases the stone is lodged at the entrance of the ureter into the bladder. We know from observation on the bowel that violent peristalsis takes place above the point of obstruction, while the bowel below does not contract, and it seems that the same is true of the ureter. In these cases the pain passes down as low as the testicle, and this would imply, if my reasoning is right, that the peristalsis has extended to the lowest portion of the tube. It is not likely if the stone were lodged in the middle of the ureter, and completely blocking the lumen, that a peristalsis would be set up in the part below. This is a point worth considering by those who have the opportunity of locating the stone by operation, and seems to be the explanation in the following case.

Male, aged 32, consulted me, with the following history. He had emigrated to America two years previously. For the first year he had enjoyed good health, but during the past year he had been

in such constant suffering that his health was shattered, and he had returned to his native country, in the hope that the change might do him good. He was spare and thin, walked with a slight stoop, and his face was drawn and anxious. In conversation he was nervous and irritable, and I had the greatest difficulty in getting from him a distinct account of his complaint, as he had become extremely neurotic, and mixed his mental impressions and his digestive troubles with the description of pains in various parts of his body. With strict inquiry I found that his illness began with severe attacks of pain in his back, which he referred to the left lumbar region. For three months these attacks continued until he became weak and ill. After this the pain shifted, starting over the iliac fossa and striking into the testicle, and his testicle became tender, so that it hurt him to wear his breeches. In the past few months this pain had disappeared, and he was now suffering from great perineal pain, especially at the end of micturition. From the account given by the patient the salient points have been selected, leaving out the numerous other symptoms from which he suffered, and which he had mixed up in almost inextricable confusion, besides giving his own views as he went along. It was evident that the patient had had a renal calculus, which had shifted its position and was now in his bladder, and his long suffering had reacted on the nervous system, producing very characteristic neurotic or neurasthenic symptoms. I sounded his bladder and could find no stone, but assured him that there was a calculus in his bladder. A few days after he again called to see me, a totally different man, erect and smiling, and held out to me, in the palm of

his hand, a calculus, the size of a small bean, which he had passed the previous day. My reading of the symptoms was, a renal calculus, at first lodged in the pelvis of the kidney, then at the lower part of the ureter, and finally in the bladder. The suffering had weakened and exhausted the nervous system and produced other widespread phenomena. I have already drawn attention to the well-known fact that prolonged suffering tends to produce a hypersensitive nervous system, so that other affections, such as gastric flatulence, produce exaggerated symptoms.

The reflex symptoms resulting from a renal calculus may be much more extensive, and give rise to symptoms indicative of other lesions, as already referred to on page 71. There I have instanced a case where I was summoned to do a laparotomy for obstruction of the bowel. When I saw the patient the symptoms certainly pointed to an obstruction of the bowel, for no fæces nor flatus had passed for two days, the abdomen was greatly distended, and all the muscles firm and rigid. I had much difficulty in passing my finger through the anus, on account of the firm contraction of the sphincter. The patient had had severe pains, which he very vaguely described as passing over the abdomen. While puzzling over the case he was seized with a severe spasm of pain, and I insisted upon his placing his hand on the site when it started, and on following its course when it radiated. The region thus indicated was perfectly typical of the pain of renal colic, starting in the lumbar region, and passing round and down to the groin, as in the shaded area of fig. 13. I unhesitatingly said that the patient had a renal calculus, and that the abdominal distension and

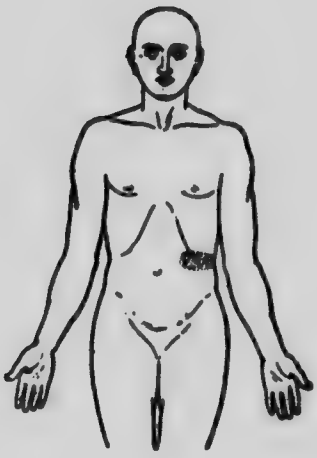


FIG. 14.

The shaded area corresponds to the site of pain and cutaneous hyperalgesia in a case of renal calculus after an attack of colic.

obstruction was due to the unyielding contraction of the sphincters, which, with the contracted abdominal muscles, were the evidence of a widespread viscero-motor reflex. The patient then stated that some few years ago he had had a similar but milder attack, followed by the passage of a small

calculus. He was given some morphia and chloral, and two days later he voided a small calculus, and all the symptoms disappeared.

The nerve supply of the viscera and their connection with the cerebro-spinal nerves is fairly constant. Sometimes it would seem as if the centres in the cord were at a slightly different level, so that the sensory symptoms are referred to regions higher or lower than the usual level. Such is the interpretation I give for the high situation of the sensory symptoms in the following case.

Male, born 1864, consulted me in October, 1900, complaining of severe spasms of pain from which he had been suffering five days. He had had similar attacks twelve years before. He referred the pain with great definiteness to the area shaded in fig. 14, page 181, this area corresponding to a region of deep cutaneous hyperalgesia—that is, the skin here is very tender if gently raised and gently pinched, but shows no increased sensitiveness to light scratching with a pin head. This area of tenderness extended round to the spine. I was in doubt as to the cause of these attacks of pain. The onset and character of the sensation corresponded to an attack of renal colic, but I had never seen a case with the pain and tenderness so high. Under treatment (rest and opium) the attacks subsided. He again consulted me for a similar series of attacks in October, 1903. He had had an occasional attack in the interval, but they were becoming more frequent. There was still present the characteristic area of deep cutaneous hyperalgesia, as in fig. 14. During one of these attacks the pain suddenly passed into the left lumbar region, and then round to the front of the abdomen, to the groin and into the left testicle. At the same

time he was conscious of the testicle being forcibly drawn up. When I examined him there was much tenderness on pressing the lumbar muscles and the left testicle. Under rest and opium the pain subsided, and two days later in voiding urine he passed a small calculus. There was complete freedom from pain until October, 1905, when he again had a few attacks of pain referred to the area shaded in fig. 14. This pain passed downwards to the groin and testicle, and again he was conscious of the testicle being firmly drawn up. He rested in bed four hours, and upon micturating he passed another small calculus. He has remained free from any further attack.

103. Symptoms of Affections of the Bladder.—The bladder in its development is derived from two sources, the allantois and the cloaca. From the former there comes the upper division, and from the latter the fundus of the bladder (the trigone). The nerve supply of the bladder is likewise from two sources, from the upper lumbar region and from the sacral autonomic (second and third sacral) (*see* fig. 1, page 25). As a result of this nerve supply the sensory symptoms are felt in two regions, in the hypogastric region, where the upper lumbar nerves are distributed, and in the perineum and along the penis, where the sacral nerves are distributed. The pain from an over-distended bladder, as in retention of the urine, is felt mainly above the pubis, and resembles in its situation and character the pain of uterine contraction or the pain of peristalsis of the lower end of the great gut. This pain is intermittent in character, and is due to the passage of waves of contraction over the bladder. When there is much irritation of the bladder, as in acute inflammation of its mucous membrane, or in the presence of a stone,

the contraction of the bladder at the end of micturition is sometimes very severe, and the pain is then felt both above the pubis and in the perineum, also along the penis to the glands. In many cases of stone, the pain from the perineum to the point of the penis is the most distinct, being felt most severely at the end of micturition, but also at other times, and particularly if the patient is jolted. The viscero-motor reflex is usually not well marked, but I have noted contraction of the lowest division of the recti in cases of stone in the bladder.

The act of micturition is a reflex that may be stimulated into activity in a great many ways. Normally there is a distinct relationship between the distension of the bladder and the act, filling of the bladder setting up reflexly the contraction of the muscular wall, which results in the expulsion of the urine. In the child the act of micturition is purely reflex, but with advancing age the individual acquires more or less voluntary control of the act of micturition.

In addition to the muscle wall of the bladder the abdominal muscles may assist by compressing the bladder, and in expelling the last drops the perineal muscles (especially the levator ani and the accelerator urinæ) play an important part. The act of micturition in the infant, or the calls to micturate in the adult, may be so frequent as to raise the question of some abnormal accentuation of the stimulus. This may arise in a great many ways, as in the excessive quantity of urine secreted (in diabetes and certain forms of Bright's disease), the irritating nature of urine as in concentrated or very acid urine, the presence of abnormal ingredients as oxalates, pus, blood, calculi. The wall of the

bladder may be inflamed and irritated, so that a small quantity of normal urine may serve as a stimulus. Stimuli from other organs and tissues affecting the spinal centres of the bladder may provoke frequent micturition, as in affections of the kidney, ureter, anus, and perineal region. Or there may be an irritable focus in the cord, due to lesion of some other viscus, which invades the bladder centre, so that impressions from the healthy bladder have an exaggerated effect and cause the frequent micturition seen in such cases as renal calculus, appendicitis, affections of the ovary and uterus, and piles. In these cases there will always be found some region of hyperalgesia in the external body wall characteristic of the particular organ at fault. A cause of frequent micturition often overlooked is over-distension of the bladder from some such obstruction as enlarged prostate in the male, or pregnancy or pelvic tumour in the female. Examination of the resonance above the pubis may reveal the dullness due to a distended bladder in the male, but when there is a pregnant uterus, or other tumour, it may not be possible to recognise the distended bladder. The doctor, misled by an account of frequent micturition, may fail to detect the trouble, and very serious consequences may result from this being overlooked. In pregnancy, with retention of urine of this sort, the patient may die if relief is not speedily obtained.

Functional Symptoms.—Although the chief function of the bladder is to retain and expel the kidney secretions, it, like other mucous membranes, has a secretion of its own. This secretion is normally only perceptible in very delicate analysis of the urine. The contents of the bladder may irritate the

mucous membrane, so that its secretion may be more abundant, and may become perceptible as a haze at the bottom of the glass when the urine has cooled and stood for some time. This mucous secretion may increase in quantity with the irritation or inflammation of the bladder wall, till the urine becomes thick and viscid, and even blood-stained, according to the degree of inflammation. Pus also may be secreted from the inflamed mucous membrane, or from an ulcer. These abnormalities, however, are to be detected by following the usual routine of urine examination, with which I do not propose to deal.

Structural Symptoms.—Changes of the organ can only be detected by its increase in size above the pubis, or by exploration with the finger in the rectum or vagina. In either case, when abnormalities are detected, additional evidence has to be sought by examination of the bladder by the catheter, by sounding, or by use of the cystoscope.

CHAPTER XVII.

AFFECTIONS OF FEMALE PELVIC ORGANS.

104. *The Uterus.*
105. *The Ovaries.*
106. *The Vagina.*

I have been unable to satisfy myself as to the sensibility of some parts of the female pelvic organs. The uterus above the cervix is certainly insensitive to ordinary stimuli, for I have many times tested the interior, with my whole hand in the uterus, during and after labour, and also in scraping out the contracted uterus. The pains during labour are undoubtedly referred, as I shall describe later. I cannot form any definite opinion of the sensibility of the cervix, or for that matter of the vagina. In regard to the cervix I have been able to pinch it and to prick it, with no sensation, but on the other hand great pain is often experienced when an attempt is made to dilate it. But whether this is a direct or a referred pain I could not decide. The patient is so conscious of the stimulation of the external genitals that her statements become affected by suggestion, and the reference is too vague to be of use. In the same way the extent of the supply of cerebro-spinal nerves to the vagina is not understood, nor could I determine the limits by stimulation, for the sensory nerves are modified for special sensations. The

tendency to exaggerated reflexes in most cases adds to the confusion, for such patients will say they experience a sensation before they are stimulated, and in their apprehension they anticipate or exaggerate the result. A further complication results from the difficulty in diagnosis, it being very rare to obtain a satisfactory proof of the nature of the ailment in cases showing what seemed the most typical evidence of referred symptoms. In the following brief description the subject is dealt with so far as reliable evidence could be obtained.

104. The Uterus.—The pain of uterine contraction is a distinctly referred one, though this seems scarcely probable on superficial observation. In palpating the pregnant uterus during labour the onset of the contraction and the pain are simultaneous and evidently so distinctly related that it seems improbable that the pain is not a direct one, especially when the pain is so often described as being felt across the abdomen in the region where the uterus is felt contracting. But if the matter be inquired into more carefully it will be found that the pain is frequently not felt across the abdomen, but across the back at the level of the top of the sacrum. Here again the hasty observer has attributed the pain to the child's head "distending the cervix," or "pressing on the lumbar plexus"; but this pain is referred here before the cervix is distended, and also after the child is expelled, during the "after pains," when the uterus can be found to contract, while the patulous cervix is untouched. This pain in the back is found not only in labour at full term, but also during a miscarriage. The pain referred to the front of the belly, between the umbilicus and pubis, is also present when the uterus

is not an abdominal organ but a pelvic one, as in miscarriage, after-pains, and other causes that induce uterine contraction. It is well seen in the severe spasms of pain that occasionally occur when some fluid from a vaginal douche escapes into the ut us and sets up uterine spasm.

In rare cases we may find the pains of the contraction of the pregnant uterus at a distinctly lower level, and in one case the pains were all felt across the upper front portion of the thighs.

Very exact delimitation of the area of pain is not possible, but the region in which uterine pain may occur extends from the tenth thoracic to the third lumbar nerves, though in any individual case it is restricted to a limited portion of that distribution.

105. The Ovaries.—The nerve supply of the ovary is not exactly known, but, like the testicle, its development starts higher up in the abdomen than the position it occupies in adult life. The testicle has been shown to be developed between the tenth and twelfth dorsal vertebræ, and the nerve supply presumably comes from the same region. So far as I have been able to make out, the pain felt in ovarian trouble is referred to the lowest part of the abdomen of one side, and over the groin in the position in which the testicular pain is felt. The lowest portion of the abdominal muscles in this situation readily becomes hyperalgesic and contracted. This characteristic region of tenderness has often misled observers into the belief that the pain evoked by pressure in this region was due to a "tender ovary," a statement with some truth in it, but not in the sense intended, for the ovary itself in such cases is not affected by the pressure, the

pain of the pressure arising from the stimulation of the hyperalgesic skin or muscle.

Beyond an indefinite patch of hyperalgesia of the skin in the region of the groin, extending sometimes for a variable distance down the thigh, I have not been able to make much that is reliable out of the hyperalgesic area of ovarian disease. It is in these cases we often find such widespread areas that it is doubtful how much is due to the actual ovarian lesion.

Associated with all forms of pelvic trouble are a number of other reflexes. Thus the breasts frequently become tender, especially at the menstrual period. A cough is sometimes spoken of as being "uterine," or of ovarian origin, but I have not been able to convince myself of such a thing. Vomiting is a frequent reflex symptom, particularly in pregnancy, but here it is probably not of a reflex nature, but of a toxæmic. As I have already remarked it is sometimes a pure reflex, as in the vomiting associated with the uterine pains.

106. The Vagina.—The character of the pain in vaginal affections is so ill-defined that it is difficult to say whether it is direct or referred. This is seen in the cases of urethral caruncle, where the pain may be of a very severe form and the localisation so vague that the detection of the cause is often a matter of some difficulty. It resembles in some respects the severe vague pain of an anal fissure. A powerful reflex contraction of the muscles that act as sphincter of the vagina, on certain conditions of irritation of the vaginal mucous membrane, may produce vaginismus.

CHAPTER XVIII.

PERITONITIS AND PERITONEAL ADHESIONS.

107. *Insensitiveness of the Peritoneum.*
108. *Symptoms in Peritonitis.*
109. *Symptoms in Peritoneal Adhesions (Parietal).*
110. *Symptoms in Peritoneal Adhesions (Visceral).*

107. Insensitiveness of the Peritoneum.—I have already referred to the fact that the serous surface of the peritoneum is insensitive to any form of stimulation, but that the external layer of the parietal peritoneum is an extremely sensitive structure, stimulation of which produces the sensation of pain (page 33). It is commonly assumed that the peritoneum is an extremely sensitive structure, particularly when inflamed. I must say, however, that I have found no evidence of any increase in the sensibility of the inflamed serous surface when I have stimulated it directly, and I have done this repeatedly in patients free from any form of analgesic. To a certain extent the popular misconception of the sensibility of the peritoneum has arisen from the fact that no attention has been paid to the hyperalgesia of the structures of the external body wall, including the

external layer of the parietal peritoneum. The result has been that the evidence of peritonitis is almost invariably based on the pain and tenderness on pressure—evidence which, as I have endeavoured to demonstrate, is not due to peritonitis, but to the hyperalgesia of the structures of the external wall. That peritonitis may produce these symptoms is true, but it does so in the same way as the viscera produce them—*i.e.*, by reflex stimulation. The reason of the insensibility of the peritoneum is the same as that for the insensibility of the viscera, namely, that the nerve supply of the peritoneum arises from the sympathetic, with the exception of the external layer of the parietal peritoneum, where the nerve supply is from the cerebro-spinal nerves.

108. Symptoms in Peritonitis.—If we take a case of acute peritonitis a careful analysis of the symptoms reveals their true nature. Thus, in a case of ruptured gastric ulcer, where there was an extensive peritonitis limited to the upper part of the abdomen as shown by post-mortem examination, the patient lay on her back with the knees drawn up, partly to relax the abdominal muscles, and partly to avoid the pressure of the bed-clothes on the abdominal wall. She shrank at the first attempts to palpate the abdomen, and when the skin was tested it was found extremely hyperalgesic, the lightest touch producing the sensation of pain. The area over which this hyperalgesia extended had no definite relation to the extent of the peritoneal inflammation. Thus, for instance, in marking out the limits of the cutaneous hyperalgesia I found it extended for a few inches up over the chest and down over the thighs, the margin fading away indefinitely. The sensibility of the muscles of the

abdominal wall could not be tested on account of the hyperalgesia of the skin over them. They were, however, partially contracted, and the lightest palpation produced a rapid and strong reflex contraction.

In less extensive peritonitis these symptoms may be limited to a small portion of the abdominal wall, and when they are present it is impossible to distinguish them from the hyperalgesia and muscular contraction due to some visceral affection. The hyperalgesia following an attack of gall-stone colic, or due to a gastric ulcer, is almost invariably attributed to a "peritonitis," and this view is supposed to be proved when, during operation for gall-stones, a certain number of peritonitic adhesions are found. While peritonitis can produce hyperalgesia of the external body wall, it should always be borne in mind that the viscera can also do this, and when hyperalgesia is found in gastric ulcer, after gall-stone, renal or bowel colic, the cause of the hyperalgesia is in all likelihood not peritonitis, but the presence of an irritable focus in the spinal cord, the outcome of the violent visceral stimulation.

109. Symptoms in Peritoneal Adhesions (Parietal).—I have broken down adhesions and found them insensitive, but when they are attached to the parietal peritoneum, dragging on them may produce severe pain. Ramström also describes the serous surface of the parietal peritoneum as insensitive, but pulling on the adhesions attached to the parietal layer causes pain, thus agreeing with my own observations. I attribute this to the fact that the inflammation that resulted in the production of the adhesions has extended to the peritoneal layer supplied by the cerebro-spinal

sensory nerves. The difficulty in distinguishing between visceral pain and the pain due to the invasion of the external body wall is very great. In many visceral ailments the inflammatory affection extends and involves the sensitive structures of the abdominal wall, and with this extension a new train of symptoms arises, which may lead to wrong inferences if these differences in the sensibility of the structures are not clearly kept in view. One can easily see how appendicitis may give rise to symptoms which are entirely confined to the reflex group, until the inflammation extends to the abdominal wall, when another series of symptoms may arise which are produced by a different mechanism, and which are detected in the immediate region of the inflammation.

For the study of the symptoms of adhesions those formed after operation offer the best opportunity, inasmuch as their presence can be inferred and the operation has determined the condition of the viscera. Maylard says: "It is doubtful whether any opening of the general peritoneal cavity ever takes place without the subsequent formation of adhesions, for no tissues of the body seem so ready to exude a plastic cementing material, which glues almost at once any structure lying in contact with it." It is probably due to these adhesions that so much pain and tenderness is felt after some simple abdominal operation, even when the operation is purely exploratory, and no injury has been done to any viscus. The hyperalgesia in such cases is often muscular, and associated with a lively reflex of the hyperalgesic muscles, so much so that their exercise, as in walking, may result in their shortening from an increase of their tonic contraction, for a

longer or shorter time. Small portions of these muscles may remain firmly contracted for long periods, and sometimes they so closely resemble a tumour in the abdomen that it is impossible to tell whether the hardness is a contracted muscle or not.

In a case of pyloric stenosis, in which gastro-enterostony had been performed, muscle pain and tenderness persisted in the left rectus muscle. As the patient experienced no relief, she again consulted the surgeon who had performed the operation. He detected a small tumour in the abdomen, and insisted on an operation for its removal. I thought the tumour was a contraction of a portion of the fibres of the left rectus muscle at the upper portion of the second interseptal division. As, however, the surgeon was very confident of his opinion, and I was less sure of mine, the abdomen was opened. No tumour was detected, but there were numerous fine adhesions attached to the parietal peritoneum, stomach, and bowel. It was manifest that the apparent tumour had been entirely muscular, this contraction being in the nature of a reflex, for there was no extension of the inflammation from the adhesions to the muscles.

110. Symptoms in Peritoneal Adhesions (Visceral).—Adhesions limited to the visceral peritoneum may produce no symptoms, or they may produce very well-marked reflex contraction of the muscles, with more or less hyperalgesia of the skin or muscles. This subject has not been worked out, and I have only been able to investigate it to a limited extent. It seems, however, one worthy of attention, and there are plenty of opportunities for its study, if careful notes of the condition be made before operation. For many years I applied it in

the diagnosis of ovarian tumours to ascertain whether there were likely to be adhesions or not. Then I found that when the muscles of the belly-wall were not contracted and not tender there were no adhesions between the ovarian cyst and surrounding structures. When, however, there was much muscular contraction and hyperalgesia, adhesions were always found between the tumour and the surrounding organs. As, however, these observations were made and verified in only some twenty cases, they are manifestly insufficient for a definite statement, but I put forth this suggestion as a line of observation well worth consideration.

CHAPTER XIX.

AFFECTIONS OF THE LUNGS AND PLEURA.

111. *Nature of the Subjective Sensations.*
112. *The Respiration.*
113. *Reflex Symptoms.*
114. *Functional Symptoms.*
115. *Structural Symptoms.*
116. *Affections of the Pleura.*
117. *Nature of the Pain in Pleurisy.*

111. Nature of the Subjective Sensations.—Owing to the constitution and the accessible situation of the organs, the physical signs of affections of the lungs are readily ascertained, and have been so well explored that I shall do little more than touch upon some of the reflex phenomena. Even though these phenomena can be so readily recognised, their mechanism is far from clear. The chief reflex which presides over the movements of respiration involves the employment of the muscles of the body-wall over such a large area that the symptoms often become very complicated. The subjective sensations of the patient arise also from such a number of causes that it is often impossible to understand how they are produced. As in other parenchymatous organs, no form of stimulation of the lung tissue seems to be capable of producing sensation directly or reflexly.

Below the epiglottis there is no sensation elicited from stimulating the air passages, though coughing is readily induced in certain regions. The lung itself is insensitive to stimulation when healthy (as is seen when an exploring needle penetrates the lungs) or when diseased. It is well known that the lung may be acutely inflamed, torn by an apoplexy, ulcerated and scooped out by a tuberculous process, and no sensation be felt by the patient. When pain arises in connection with affections of the lung, it is from the implication of the pleura in the disease process, or from the muscles of respiration becoming sore and tender from excessive exercise.

Although no pain arises in connection with lung affections, other sensations appear, as the sense of breathlessness, "air hunger," and a sense of suffocation. These sensations may be the occasion of acute distress, and provoke attempts at deep inspiration.

Dr. Haldane considers it "probable that 'air hunger' is always due to excitation of the respiratory centre in consequence of an abnormal condition of the blood. Nothing else is known to produce 'air-hunger.' The excitation may be due to (1) excess of CO_2. This is the normal excitant. The excess of CO_2 may be due to hindrance to entry or exit of air (asthma, bronchitis, etc.), or to hindered penetration of CO_2 from the blood to the alveolar air (pneumonic or dropsical conditions in the lung). A second cause is diminished alkalinity of the blood. This acts just like CO_2 on the centre. A typical example is the hyperpnœa of diabetic coma (oxybutyric acid in the blood). If want of O_2 arises in the tissues from hindered absorption

of O_2 by the lungs, from defective circulation (as in uncompensated heart disease) or other causes (CO_2 poisoning, poisoning by nitrites, or other substances, which disable the hæmoglobin, etc.), the blood also becomes less alkaline from lactic acid formation, or lactic acid is formed in the centre itself. The centre is thus stimulated, and hyperpnœa, as a secondary result of want of O_2, results. Want of O_2 does not seem to be a *direct* stimulus to the centre. It is only in a limited number of cases that pure O_2 can relieve dyspnœa."

112. The Respiration.—The movements of respiration consist in the contraction of certain muscles, increasing the size of the chest cavity, and producing the inspiratory act. The muscles employed in the act of respiration are the diaphragm, the external intercostal muscles, the levatores costarum, and serratus posticus superior. As these muscles in their contraction enlarge the cavity of the chest by raising the thorax and twisting the costal cartilages, and thus stretch the elastic tissue of the lungs, so when they cease to act the thorax falls by its own weight, assisted by the recoil of the costal cartilages and the elastic tissues of the lungs. The thoracic cavity is thus reduced, and the air is expelled. It is possible that the internal intercostal muscles contract with each expiration. In both forced inspiration and expiration a large number of accessory muscles may take part in the respiratory movements.

Although the nerve supply of these muscles involved in respiration come from widely separated portions of the cord, they are all under the dominance of one centre in the medulla oblongata—the respiratory centre—the *nœud vital* of Flourens,

situated in close proximity to the nuclei of the vagus nerves.

The normal rate of respiration is from fourteen to sixteen per minute, when the body is at rest. Abnormalities are usually considered from the standpoint of increase in rate and violence of the act of respiration. There are, however, conditions of slow respiration, apart from mechanical obstruction, which are of some interest, as they are associated with certain neurotic conditions, and the slow respiration produces a form of heart irregularity (sinus arrhythmia). However variable the rate, Dr. Haldane points out that the alveolar ventilation will be the same—the frequent breathing being shallow, and the slow breathing deep.

Although the physiology of respiration so clearly defines the method by which respiration is regulated, yet there is nothing so perplexing to explain as the influences that operate in producing abnormal forms of respiration. In any given case of increased frequency of respiration it is difficult or impossible to say whether the condition is the result of imperfect aeration or reflex stimulation. The presence of non-striped muscle fibres in the smaller bronchi leads to the surmise that these may become tonically contracted, and therefore prevent the entrance of air to the alveoli.

This action seems all the more probable when we reflect that asthma is so often the outcome of a remote stimulation, as from the nasal cavity, and muscular contraction is so susceptible to reflex stimulation. Dyspnœa of a very severe form may arise from peripheral stimulation, as is seen in pneumonia, or pulmonary apoplexy, when the breathing may be greatly increased in frequency

and in violence. The alteration in the breathing is not the outcome of a diminution of the breathing space by the inflammatory exudation, or apoplexy, for the rate of breathing may suddenly return to the normal, with no diminution in the extent of the affection of the lung. Presumably here the increased respiration is the outcome of a reflex, but whether the stimulation played directly upon the respiratory centre, or whether it caused a reflex spasm of the bronchial muscles, we cannot tell. The dyspnœa arising from other sources is equally obscure. Dr. Haldane considers "the respiratory trouble in heart disease (uncompensated) to be due (at least mainly) to the slowed circulation, and consequent imperfect aeration of the tissues. The deficiency of O_2 in the tissues will cause increased formation of lactic acid, and consequent diminished alkalinity of the blood, and consequent necessity for an abnormally great removal of CO_2 from the blood. The increased respirations may also materially assist the circulation by aspirating more venous blood towards the heart. The breathless healthy person is breathless from excess of CO_2 in the arterial blood. In heart disease there is no excess of CO_2, or deficiency of O_2 in the arterial blood, but this condition exists in the tissues owing to the slow circulation. Slight hyperpnœa will diminish the CO_2 in the arterial blood, and thus compensate for excess of CO_2; but hyperpnœa cannot appreciably increase the oxygen in the arterial blood, and therefore cannot compensate for the want of O_2 in the tissues. The patient is therefore blue, although his breathing may not be noticeably increased. Exertion during any condition where the circulation (particularly in the coronary vessels) is defective, and cannot be

increased in response to the increased need for blood, will lead to a fall of blood pressure, the heart being incapable of supplying enough blood to correspond to the increased flow (vaso-dilatation) in the working muscles. Fainting will thus be caused. The same effect is seen in CO_2 poisoning, where even a slight exertion produces fainting with absolute certainty, and may be fatal."

113. Reflex Symptoms.—*Cough.*—Coughing is essentially a reflex phenomenon, the centre for which is one of the numerous areas associated with the main respiratory one in the bulb. The stimulus is conveyed from the periphery by some branch of the vagus. The result of the stimulus is to cause first a deep inspiration, which is followed by a closure of the glottis, then by a sudden and powerful contraction of the muscles of expiration which forces the air through the resisting glottis. By this process the air drawn into the lungs by the preliminary inspiration is driven out with such force that all movable matter in the larger tubes is swept out. The area that most readily excites the cough reflex is the mucous membrane of the larynx, the nerve supply being from the superior laryngeal nerve, a branch of the vagus. The respiratory tract below the larynx, and the lung tissue seem to be incapable of originating the stimulus. The cough in affections of the lung arises only when the secretion has been carried by the contractions of the bronchial muscles, and by the cilia of the respiratory tract so far upward as to reach the sensitive region about the larynx. Thus it is that in pneumonia the cough may be only slight, and only provoked when the secretion has passed up the respiratory tube. In phthisis and abscess, and

all cases where there is abundant expectoration, it is to be noted that the starting of a cough after a period of quiescence is followed by a persistence until the accumulated matter is expelled. Here the first cough is initiated by the gradual conveyance of the phlegm to the sensitive area, while afterwards the cough forcibly expels the contained matter, and so keeps up the irritation until there ceases to be forced out any more secretion. This sensitive region may be stimulated by the inhalation of cold air, and it seems to be the starting place of the spasm of uncontrollable coughing in whooping-cough. While this is probably the true explanation of the great majority of cases, coughing can also be excited by stimulation by other means. When a pleuritic effusion is aspirated, scratching the visceral pleura will often produce a cough, or irritation of the branches of the vagus that go to the stomach or ear may produce coughing. It is always well to exclude the possibility of irritation in the larynx, before assuming the presence of the more remote stimulation. A very curious cough reflex is sometimes present in persons who have an occasional extra-systole. This is usually due to the ventricle contracting prematurely before the auricle, and the individual may be conscious of this, and may give at the same time a short cough—without the preliminary inspiration. In hysteria violent and persistent coughing may occur either from a trivial laryngeal irritation, or it may be in consequence of some other reflex irritation.

Sneezing.—A reflex of a somewhat similar nature to that of coughing arises from stimulation of the mucous membrane of the nose. It differs from a cough, inasmuch as there is no closure of the glottis,

and the blast of air is sent through the nose as well as the mouth. It also differs from the act of coughing in always being a pure reflex. Coughing can be done voluntarily, but sneezing cannot. Sneezing can be inhibited by biting the upper lip, or pinching the edge of the nasal bones, even after the preliminary inspiration, and by a mental reaction, as when another person is observed to imitate the act.

Persistent attacks of sneezing are commonly associated with a swelling of the erectile tissue over the turbinate bones in the nose, and a free secretion from the mucous membrane of the nose and eyes.

114. Functional Symptoms.—*Aeration of the blood.*—Impaired function is seen in the degree of aeration of the blood, and in the character of the expectoration. Aeration of the blood is the main function of the lungs, and imperfect aeration is manifested in the production of the reflex phenomena (air-hunger, increased respiratory movements) and in the colour of the blood. The former of these symptoms has already been discussed; the latter is observed mainly in an abnormal colour of the external tissues, as in the lips, cheeks, or skin generally.

As in all other respiratory symptoms, the production of the signs of imperfectly aerated blood is obscure and complicated. The face may show a slight degree of duskiness, the redness be a little darker than that of health, or the redness of the lips a little deeper in cases, say, of mitral stenosis. Blueness of the lips may be due to imperfect aeration of the blood in the lungs, but it also may be due to slowing of the circulation. It is remarkable how much darker the venous blood becomes if the rate

of flow through the capillaries be diminished. This is probably the cause of the cyanosis in congenital heart disease. In some cases there has been found a great increase in the number of red blood corpuscles, and a certain degree of duskiness is found in cases of polycythemia. Where there is a duskiness due to some permanent condition as polycythemia, or the cyanosis of congenital heart disease, exertion often increases the depth of the cyanosis.

In failing hearts, with embarrassment of the pulmonary circulation, a very considerable duskiness may be evident, as also in cases where there is obstruction to the entrance of air into the lungs. As the heart is exceedingly susceptible to oxygen, imperfect aeration of the blood has a very marked effect upon it, a diminished supply of oxygen acting speedily in stopping its action, and in the administration of chloroform this is one of the most important facts to be borne in mind.

Expectoration.—Expectoration is the product of perverted function, and may be due to a secretion of the respiratory tract or lungs. It may also come from regions outside the lungs, as when an abscess or pleural effusion bursts into the lungs, or bronchi. It is the most frequent cause of cough, and coughing is due to the attempt to get rid of the secretion. The expectoration is conveyed in the first place by the contraction of the bronchial muscles, and by the cilia of the respiratory tract to the bronchial tubes, till an excitable part is reached, when coughing is induced, and the blast of air expels the accumulated secretion. The force exercised in compressing the chest helps to expel secretion accumulated in any part of the respiratory tract, or in the lungs and pleural cavity, so long as there is an exit.

The character of the expectoration indicates its source, a transparent and frothy expectoration coming from the upper air passage, while the more viscid comes from the lower, or from near the alveoli, as in the early stages of pneumonia, when it is usually stained more or less deeply with blood. A clear, pink-stained mucus may result from a pulmonary apoplexy. A purulent sputum is due to a lesion of some standing. In bronchitis the sputum gradually changes from a mucus to a muco-purulent character. An abundant muco-purulent sputum is found in chronic bronchitis and old standing catarrhal pneumonia. With an excess of fever, the latter condition may resemble an attack of acute croupous pneumonia, but the abundant purulent secretion serves to indicate the nature of the illness. The secretion from phthisical cavities is also purulent. When large quantities of pus are expectorated, the source is a cavity in the lungs or pleura, or a subphrenic abscess, as a suppurating hydatid cyst of the liver.

The microscopic examination for tubercle bacilli and elastic fibres is fully detailed in text-books.

115. Structural Symptoms. — Structural symptoms are recognised by changes in the consistence of the lung tissue, in the invasion of the normal resonant area by structures of more solid consistence, changes in the shape of the chest wall, and the presence of accessory sounds or the modification of the normal respiratory sounds in auscultation. It is not my purpose to enter into the details of these changes, and I merely point out here that the existence of any abnormal state can only be ascertained by thorough knowledge of the normal condition of the lungs. The position of the lungs in relation to

other organs, the modification of the signs of the lung in the different regions of the chest, should all be familiar through the systematic examination of a great number of healthy people. In all these observations, and more particularly in the examination of abnormal or diseased lungs, the recognition of the abnormal signs depends on the comparison of the signs in one individual with another, or in the comparison of the signs on opposite sides in the individual examined. As there are infinite gradations, it requires careful training to recognise many of the more delicate but none the less very important phenomena.

116. Affections of the Pleura.—*Insensitiveness of the Pleura.*—If the affection of the lung gives rise to no sensation of pain, the same cannot be said of the pleura, for the pains associated with pleurisy may be of the most violent kind. In consequence of this well-recognised fact, the pleura is supposed to be an extremely sensitive structure, though, as a matter of fact, it is as insensitive as the peritoneum to ordinary stimulation. In a great number of cases, when the ribs have been resected, I have repeatedly explored the pleural cavity for any evidence of sensation, and I could employ no form of stimulation capable of producing pain. When I probed the visceral pleura, even to penetrating the lung, no sensation was produced; when I scraped the surface of the parietal pleura no sensation was produced, unless I pressed with some force, when a vague sensation was experienced, due probably to the pressure being exercised on the structures of the external body wall.

117. Nature of the Pain in Pleurisy.—From the result of such experience one is forced to consider carefully how the great pain felt in pleurisy is

produced. Inquiry into the nerve supply of the pleura is fruitless, for there is practically no information about the matter in either anatomical or physiological text-books. Although I carried out a series of careful dissections of intercostal nerves to their finest branches, I could detect none entering the pleura. Whether there is a layer containing fine nerve endings outside the pleura similar to that described by Ramström lying outside the peritoneum, I do not know. A careful study of all the phenomena connected with a painful pleurisy reveals the mechanism by which it is produced, and gives some indication of its nerve supply. The most severe pain occurs in the movements of respiration, and is due to the painful contraction of the intercostal muscles. In the abdominal muscles the muscular hyperalgesia and tonic contraction can be demonstrated. It is not so easy to do this in the case of the intercostal muscles, but there is good reason for inferring that the viscero-motor reflex is as definite in pleuritis as in peritonitis. The muscles are often tender on pressure, and their contraction is not only painful but ends in a spasm which restrains the movements of the chest. The symptoms of pain and violent contraction are identical with those that occur when the muscle is hyperalgesic, apart from a pleurisy, as in the painful contraction of the intercostal muscles in "muscular rheumatism," and in those cases where the hyperalgesia extends into the chest wall from affections of other viscera, as in gall-stone disease (*see* page 155).

The mechanism of the pain can also be inferred from those cases in which the pain is felt at a distance from the inflamed pleura. When the diaphragmatic pleura is inflamed the pain may be felt in two regions

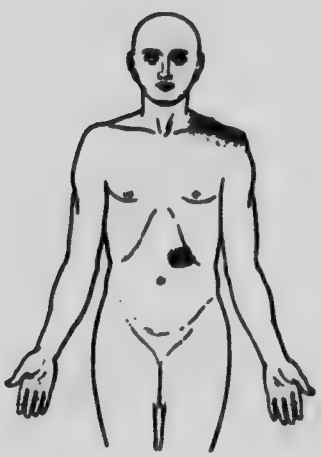


FIG. 15.

Areas in which pain and hyperalgesia were present in a case of diaphragmatic pleurisy. The shaded area on the left shoulder is in the cutaneous distribution of the fourth cervical nerve, and is an evidence of the conduction of a stimulus from the diaphragm by the phrenic nerve, which leaves the spinal cord with the fourth cervical nerve. The phrenic nerve contains afferent fibres as well as efferent (motor), and it is in all probability by the former that the stimulus is conveyed to the centre of the fourth cervical nerve in the cord. The shaded area in the abdomen is in the region of distribution of the 8th and 9th thoracic nerves.

very widely separated, namely, in the abdomen below the ribs and on the top of the shoulder (fig. 15).

It not infrequently happens that the onset of pneumonia is accompanied by a severe pain in the abdomen, and the skin in the region where the pain is felt may be found extremely hyperalgesic. (Not infrequently, and particularly in the young, this pain misleads in the diagnosis, giving the impression that some abdominal viscus is at fault.) The area in which this hyperalgesia is found is within the peripheral distribution of the eighth and ninth thoracic nerves. I have no distinct proof that in such cases the pain and hyperalgesia are due to pleurisy, and not to the lung affection, except for the very common experience that the inflammation of the lung is painless, while inflammation of the pleura is usually associated with pain, and the hyperalgesia may be detected in basal pleurisies without pneumonia. It is evident that there must be some correlation between the lesion and the area of hyperalgesia, and as no nerve from the region of the eighth or ninth thoracic nerves supplies the lungs it is reasonable to conclude that the nerve supply from the inflamed pleura must be from this region. The pain felt in the shoulder is more instructive. It is, however, a somewhat rare phenomenon, but in the few cases I have seen in which there has been cutaneous hyperalgesia, the area could be marked out very distinctly, and is found to be within the distribution of the fourth cervical nerve. I have already dealt somewhat fully with the distribution of the phrenic nerve and its relation to the fourth and fifth cervical nerve (*see* page 45). Its distribution being to the diaphragm, and not to the lungs, permits of the

reasonable inference that the pain and hyperalgesia in the shoulder found associated with pneumonia are due to the pleurisy and not to the pneumonia.

From the consideration of these facts we can draw the inference that the pain in pleurisy is due to a reflex stimulation (viscero-sensory reflex), and that as there arises also a hyperalgesia of the intercostal muscles, their contraction is not only painful, but their continued exercise increases the violence and painfulness of their contraction. As happens in all muscles affected by a visceral stimulus (viscero-motor reflex) there is a great tendency with exercise for the muscle to be tonically contracted, and hence the constrained and limited movements of the chest wall present in pleurisy.

CHAPTER XX.

AFFECTIONS OF THE CIRCULATORY SYSTEM.

118. *Heart Failure.*
119. *The Nature of the Symptoms in Heart Failure.*
120. *Consciousness of the Heart's Action.*
121. *Breathlessness.*
122. *Viscero-sensory and Viscero-motor Reflexes.*
123. *The Viscero-sensory Reflexes in Dilatation of the Heart and Liver.*
124. *The pain of Angina Pectoris is a Viscero-sensory Reflex.*
125. *Evidences of the Viscero-motor Reflex.*
126. *Organic Reflexes.*
127. *Summation of Stimuli the cause of Angina Pectoris.*

There is no system in the body whose function can be so well observed, and whose size and position can be better made out than that of the circulatory system. As a consequence of this accessibility the circulatory apparatus has received a great deal of

attention, and innumerable methods are employed in the investigation of its action. The value of many of these methods is unquestioned, but unfortunately the tendency has been to place undue reliance on the results obtained by mere physical examination, and to neglect the more important features to be derived from the reflex phenomena, chiefly expressed in the sensations felt by the patient.

118. Heart Failure.—In order to realise fully the meaning of cardiac symptoms, it is necessary to appreciate the mechanism of heart failure. By heart failure is meant the inability of the heart to maintain the circulation efficiently. The lack of efficiency may be made evident in extreme cases by such signs as orthopnœa, dropsy, unconsciousness. On the other hand, the failure of the heart to maintain an efficient circulation may be manifest long before these extreme symptoms appear. The first sign is a feeling of distress when the patient makes an effort. This may vary within very wide limits; for instance, turning over in bed may exhaust the heart's strength, or the patient may be unable to walk across the room, or a short distance, or up a flight of stairs, without some form of discomfort checking him. The exhaustion of the patient's strength in such circumstances is seen simply as a limitation of the heart's power to respond to effort. Each individual has become accustomed to what he can do with comfort, and he recognises his heart failure by not being able to exert himself with comfort to the extent he had formerly done. The symptoms produced in health by over-exertion are frequently identical with those produced by slight exertion when the heart has become weakened

and where this slight exertion is more than can be done with comfort. It will thus be seen that the symptoms of heart failure are really recognised by a limitation of the field of cardiac response, that is, the patient finds he is stopped, on a slight exertion, by the symptoms which, when in health, only stopped him after a prolonged, exhausting exertion.

This weakness of the heart can be expressed in another way, namely, the premature exhaustion of reserve force. It is because the heart possesses the power to lay up a reserve of force that it is able to respond to calls on its energy, so that it can accommodate itself to the varying activities of the body. When the body is at rest the heart not only overcomes the resistances opposed to its work with ease, employing only a portion of its power, but it is at the same time building up a store of energy ready to be liberated when the next call is made by the body for more work. After severe bodily labour the store of reserve force becomes exhausted, and if the labour be persisted in, there arises a feeling of distress, which expresses the exhaustion of the heart's reserve force. It is this faculty of building up a sufficient reserve store that distinguishes a healthy heart from a weakened heart, and the first evidence of weakness is shown by a too speedy exhaustion of the reserve. This is made evident by distress being aroused when the individual undertakes some form of exertion he had been wont to do with ease—that is, by a limitation of the field of cardiac response.

It will thus be seen that the symptoms of heart failure in the first instance are personal, due to the patient's recognition of his limitations. The estimate is therefore a very variable one, and depends on each individual recognising his own limitations, and

detecting when these limitations become narrowed. Each individual obtains a fair estimate of his power of exertion, and this is his measure of health. A limitation of these powers in an intelligent patient calls attention to his condition. It will further be observed that the main symptoms of exhaustion of reserve force are the same when a healthy heart exhausts its store after a prolonged effort as when an enfeebled or diseased heart exhausts its limited store by a slight effort. These symptoms are in the main subjective and reflex, though certain changes may also be made out in the size of the heart and its rate and rhythm. It is, however, the subjective and reflex symptoms that are of the greatest importance, whatever may be the nature of the functional or structural lesion.

It will frequently be found that patients whose hearts show many forms of functional and structural abnormalities (valvular murmurs, cardiac enlargement, irregular action) have such a store of reserve force that they can pursue laborious occupation with ease and comfort, and live to a good age. On the other hand, patients may show no physical sign of abnormality; the heart may be normal in size and in rate, and regular in rhythm, and the sounds be clear and free from murmur; but the reserve force be so small that the slightest exertion entails at once distressful symptoms of heart exhaustion, and lives of the persons may be very precarious.

119. The Nature of the Symptoms.—The value of symptoms thus depends upon the estimation of the amount of reserve force stored up in the heart muscle. An imperfect valvular apparatus is but an embarrassment to the heart muscle in its work. We can detect that valvular imperfection by the

presence of a murmur, but we can only draw a very limited conclusion as to its bearing on the heart's work. This is really obtained by considering the amount of reserve force, and the estimation of the reserve is made by observing how the patient's heart responds to effort. The same rule applies to other forms of circulatory changes, as affections of the myocardium and of the arterial system. When, therefore, we detect what we consider to be an abnormal sign, we must not draw our conclusions from that sign alone, but must consider how far it has proved an impediment to the heart's action, and this is done by estimating the amount of reserve force. In doing this a wise discretion must be exercised, for other factors may have precipitated the exhaustion. An individual may have an organic lesion, as a valvular defect, but in addition may have been subjected to a life that predisposes to exhaustion, as excessive labour, improper or insufficient food, mental anxiety, sleeplessness; and such factors, rather than the mere valvular flaw, may be the exciting cause of the exhaustion of the reserve force. Or the individual may have a sedentary occupation, wherein, owing to lack of judicious exercise, his reserve force has gradually diminished, until some unaccustomed but not excessive effort calls attention to the limited field of cardiac response.

Not only must a careful calculation be made of these accessory, and it may be all-important, factors, but there must be a recognition of the significance of the cardiac abnormalities or supposed abnormalities. I do not enter here on the points which indicate the nature and seriousness of such abnormalities as, for instance, murmurs and heart

irregularities, but I wish to insist upon the fact that the clinician should familiarise himself with such points. For instance, a young person may have a fainting attack, and when lying quietly in bed the pulse is found very irregular. This sign, which is a perfectly normal one, though rarely recognised as such, is not infrequently linked up with the fainting attack with which, as a matter of fact, it has no connection, and the patient is subjected to unnecessary treatment and restriction, and the parent's mind becomes alarmed with the idea that the patient has a weak or diseased heart. In advanced life another form of irregularity is of extreme frequency (the extra-systole), and the recognition of its presence, with some limitation of the field of cardiac response, often leads to the conclusion that the irregularity is in some way responsible for the other cardiac signs, and energetic but futile means are taken in the attempt to cure the irregularity. In the same way this morbid dread of the unknown leads to the idea that certain cardiac symptoms as pain, especially when dignified by the term of angina pectoris, is of very grave significance. If it be once realised that pain is as constant a symptom in affections of the heart as in other hollow muscular organs, and that the pain is as readily induced by adequate causes in the heart as in the stomach, a truer perception will be obtained of the symptoms of many obscure heart affections. I shall show later that pain is one of the expressions of an exhausted heart muscle, and in order to appreciate its significance the condition that has led up to the exhaustion of the heart muscle should be ascertained—a matter usually of no great difficulty, and these conditions will guide us to a safe conclusion.

If the idea be followed up that the earliest of heart symptoms are simply due to an exhaustion of the store of reserve force, it will be found that there is a great resemblance in the reflex symptoms among all forms of heart affections—functional and structural. The most important symptoms are confined mainly to the patient's sensations and demand careful consideration. The mechanism by which they are produced is not at all times clear, and some of them are undoubtedly reflex; although I cannot give a full explanation of their production, I attempt here a brief description of the most important of the subjective symptoms and some of the phenomena associated with them.

120. Consciousness of the Heart's Action.—Under normal circumstances the movements of the heart and circulation are carried on without the individual being conscious of their action, unless he voluntarily directs his attention to the subject. When the heart is stimulated it may contract with such force that the individual becomes conscious of its action. The stimulation may arise from a great many circumstances, as, for instance, from heat, either by a rise in the patient's temperature or from a hot bath. It may arise from nerve stimulation, as from mental excitement, or from some peripheral irritation in other viscera. Its significance is greatest when it arises in consequence of exhaustion of the heart; coming on in consequence of bodily exertion, it is often the first sign of exhaustion of the reserve force. When it is thus produced, it forms a valuable sign for estimating the amount of reserve force present in the heart-muscle. It gives no indication of the conditions that have led to this exhaustion,

for it may occur in a healthy heart after prolonged exertion, as well as in a diseased heart after a very slight exertion. Under these circumstances the heart's action is usually rapid as well as forcible, but in some cases there is not much increase in rate. The consciousness of the heart's action is often spoken of as palpitation. While it may not occasion much suffering, there are individuals of a neurotic type in whom this consciousness of the heart's action causes much distress. In these patients the heart may be quite healthy, and the palpitation is then the action of an undue excitability of the sympathetic nerve supply of the heart. As other portions of the nervous system are abnormally excitable the heart's action may cause considerable distress bodily and mentally. In cases with this neurotic temperament, where there is real heart trouble, as in mitral stenosis, palpitation on exertion may be so readily induced that it acts as a protection from over-exertion, as in order to avoid its occurrence, the patient is perforce kept quiet.

The occurrence of palpitation should always lead to an examination of the nervous system as well as of the heart's condition.

A sense of suffocation is an occasional symptom in heart affection. It may be the first sign of exhaustion of the reserve force, coming on when the patient exerts himself. It may suddenly seize a patient when he is lying in bed. Its mechanism is obscure. The sensation is usually referred to the upper part of the chest and throat.

Other sensations of the heart's abnormal action may be felt by the patient. A gentle fluttering may be felt within the chest during a period of

irregular action. This may be brief and transient, or, as in certain cases of paroxysmal tachycardia, it may continue during an attack of many hours. Accompanying the latter condition there is often a feeling of exhaustion which leads the patient to rest, or to go about carefully and quietly. When the heart resumes its normal action the patient is at once conscious of a change and of a sense of relief. A more common sensation is that when the heart is felt to stand still, in what is called intermittent action of the heart. This sensation is usually felt in cases of extra-systole, which is so frequent in advanced life though occasionally present in the young. Here the ventricle contracts prematurely, and often before the auricle; this premature beat or extra-systole is followed by a long pause, and it is this pause which often alarms the patient. After the long pause the next beat is frequently big and powerful, and the patient may be conscious of the shock due to this. In nervous people this big beat often causes much mental anxiety.

Another curious reflex is sometimes met with in these extra-systoles, the patient giving a little gasp or cough when the extra-systole occurs.

121. Breathlessness.—Breathlessness is so frequently associated with affections of the heart, that its occurrence under any circumstance necessitates a consideration of the heart's condition. It is so common a sign of exhaustion of the reserve force, that in an inquiry into a patient's cardiac symptoms the amount of exertion that can be undertaken before breathlessness occurs should be carefully inquired into. In many cases the breathlessness

may occur independently of any bodily exertion, coming on when the patient is in bed, and persisting till the patient has to sit up and breathe in a laboured fashion (orthopnœa).

The mechanism by which breathlessness is brought about in heart affections is far from clear, and so many factors are concerned in respiration that any endeavour to explain its cause would lead to such vague and indeterminate speculation that, in the present state of our knowledge, little good would result. The great point is to observe the fact, to exclude other possible causes of breathlessness (as affections of the lungs, mechanical obstructions to the breathing, anæmia, and other blood affections), and then from a study of the cardiac conditions to determine the nature of the exhaustion that has been produced. This is seldom a matter of much difficulty when a sufficient experience of the various forms of heart disease is acquired. The presence of demonstrable lesion in the heart may be a guide, as shown by modification of the heart sounds, or changes in the size, rate and rhythm of the heart. In the absence of these the age of the patient may be suggestive—if old, degenerative changes in the myo-cardium; if young, the probability of some general infection, as tuberculosis; if middle-aged, the possibility of exhaustion of the reserve force from over-work, worry, bad nourishment—in fact, the consideration of the factors that tend to exhaust the reserve force of the heart, breathlessness being often the first sign of such exhaustion.

Apart from breathlessness brought on by exertion there are some definite forms of breathlessness which are recognised as especially associated

with heart affection. The best known of these is the Cheyne-Stokes respiration, where periods of apnœa alternate with periods of laboured breathing. Another characteristic form is that in which patients are seized in the night with attacks of breathlessness, and have to sit up and breathe in laboured fashion for periods of varying duration, from half-an-hour to several hours. This form of laboured breathing is sometimes spoken of as cardiac asthma, and its onset is often mistaken for the more common or idiopathic asthma. When asthma is found to occur in people of middle or advanced age for the first time, the possibility of its cardiac origin should always be borne in mind.

In many cases the patient breathes quietly though hurriedly, with no distress, and the respiratory condition may, in consequence, be overlooked, though the rate of respiration may be from twenty to thirty times per minute. With failing hearts (as in typhoid fever, in conditions in which elderly people are forced to lie in bed, or in valvular disease) this rate tends to increase, and on examination respiration is found to be shallow and limited to the upper portion of the chest. In such cases there will almost always be found evidence of stasis or œdema at the bases of the lungs. The first sign of this condition, apart from the increased rapidity of the respiratory movement, is the detection of fine crepitations on deep inspiration heard over the base of the lung, on that side towards which the patient habitually lies. My usual method for detecting this is to ask the patient on which side he has lain, and then to ask him to sit up and to auscultate the base of the lung on the side on which he has lain. This is the first step in the physical examination of the patient.

If done at a later stage the movements may have deepened the respiration, so that the crepitations have disappeared. One usually detects the fine crepitations on the first full and deep inspiration. In the early stages of pulmonary stasis, after this thorough ventilation of the bases of the lungs, the crepitations disappear. If measures are not taken to stop this tendency to œdema, or if in spite of all endeavours the œdema increases, the crepitations become more numerous and persistent, and the lung resonance may become impaired. In fatal cases the bases of the lungs become dull, there is an absence of the respiratory sounds, and post mortem the lungs are found sodden and airless. In suitable cases there can be detected coincident with these lung symptoms evidences of the dilatation of the right heart, as epigastric pulsation due to the filling and emptying of the dilated right ventricle.

122. Viscero-sensory and Viscero-motor Reflexes.—Under these terms I include such sensory phenomena as pain and hyperalgesia of the skin, muscles, mammary glands, and the contraction of the muscles, which gives rise to a sensation described "as if the breast bone were breaking." After obtaining a full account of the patient's sensations and experiences, if careful inquiry be made in regard to a number of symptoms, as pain, constriction of the chest, soreness of the chest or arms, frequent micturition, increased flow of saliva, bad dreams, there will be found a number of phenomena which the patient does not include in his description, because his mind is occupied with the sensations which cause him suffering and discomfort. The accurate noting of these less obtrusive phenomena

will often throw a flood of light on many an obscure process and reveal the mechanism by which the more obtrusive phenomena are produced.

In the physical examination careful testing for hyperalgesia should first be made. The skin of the left chest should be lightly pinched and compared with that of the right. The breasts should be lightly compressed and the resultant sensations compared. The tenderness to pressure of the pectoralis major where it forms the anterior wall of the axilla should be tested. In the same way the skin of the neck and the sterno-mastoid should be tested. The upper edge of the trapezius muscle where it passes from the scapula to the neck should be lightly compressed along its whole border, and it will sometimes happen that certain areas will be found very tender. These are places where a small nerve trunk is pressed upon. A special area of tenderness may sometimes be found over the second and third ribs in the nipple line, and in one case, where the tenderness was very marked, I found, at the post-mortem examination, on dissection, a small nerve trunk (the internal anterior thoracic nerve).

In the application of the principles I have endeavoured to enunciate angina pectoris affords an excellent illustration, as the symptoms can be with certainty referred to the organ at fault, and because the complex of symptoms that are included in an attack of angina pectoris are capable of being analysed with great precision. This is, in a great measure, due to the peculiar distribution of the sensory nerves in whose peripheral distribution the characteristic phenomena are shown, and whose centres in the spinal cord and medulla are in close

relationship to the centres of the autonomic nerves of the heart (sympathetic and vagus). The cases I cite demonstrate that the term "angina pectoris" includes a number of reflexes, and I give in detail the more conspicuous of these, namely, sensory reflexes, where the pain and hyperalgesia affect the chest, arm, head, and neck; motor reflexes, resulting in spasm of the intercostal muscles; secretory reflexes, shown by profuse secretion of saliva and urine. Some cases show other reflexes, as the respiratory, but the discussion of these would lead me beyond the object I had in writing this book.

Notwithstanding the numerous papers devoted to the consideration of angina pectoris, practically none have dealt adequately with the analysis of the symptoms present during an attack. Angina pectoris is often surrounded by such tragic circumstances that it forms a suitable theme for disquisition, and on that account we too often get the lurid description of an impressionist artist instead of the plain, matter-of-fact description of an accurate observer. A careful sifting of all the details brings out the fact that the essential principles underlying the pains associated with affections of the heart differ in no way from those of any other hollow muscular organ. So terrifying is the attack to the patient that his perceptions of the details of his suffering are generally confused, so that often no clear account can be obtained from his description; but if he is intelligent and is asked to note particulars in subsequent attacks, he may be able to throw a very valuable light on the onset and character of the sensations he experiences. The observations made by the physician of patients during an attack also afford great help in this respect.

123. The Viscero-sensory Reflexes in Dilatation of the Heart and Liver.—Before dealing with the more characteristic attacks of heart pain, which go by the name of angina pectoris, I wish first to draw attention to the very distinct sensory evidences that arise from the dilatation of the heart. These sensory symptoms are practically identical with those that arise in cases of distension of any other viscus, as the stomach, bladder or liver. To illustrate this I select cases where the dilatation of the heart occurs rapidly, and is followed by a rapid distension of the liver, such as we find in certain forms of paroxysmal tachycardia. In certain of these cases the rhythm of the heart starts suddenly at the ventricle (or more probably at the fibres joining auricle and ventricle). The heart at once beats with great rapidity, but fails to maintain the circulation, and in consequence we have very rapidly developed great dilatation of the heart, fullness of the veins, enlargement of the liver, and dropsy. I have seen a number of these cases, and in two particularly I have observed some fifteen to twenty attacks, of which the following is a typical description.

The patient may be in good health and no abnormality be detected save, in some cases, the occurrence of an extra-systole. Suddenly the heart's rate becomes greatly accelerated, to 180 beats and more per minute. In a few hours the patient's face becomes dusky, the lips swollen and livid, and there appears great shortness of breath on exertion, marked increase in the size of the heart, distension and pulsation of the veins of the neck, and enlargement and pulsation of the liver. The jugular and liver pulsation are of the ventricular type. Pain and oppression may be felt over the chest.



FIG. 16.

The areas shaded in the neck, chest and upper part of the abdomen represent the distribution of cutaneous hyperalgesia in a case of acute dilatation of the heart and liver.

The skin and deeper tissues of the left chest become extremely tender on pressure in the area shaded in fig. 16. If the left pectoralis major muscle be grasped where it forms the axillary fold it will be found extremely tender. The skin of the left side of the neck may also be tender, and if the left sterno-

mastoid muscle and the left trapezius muscle, above the middle of the scapula, are lightly grasped they may be found exquisitely sensitive. The skin and muscles over the liver will also be found extremely sensitive to pressure, and the parts hyperalgesic extend over a much larger area than the enlarged liver. If the heart's rate revert to the normal the patient at once experiences great relief, and in a few hours all signs of the circulatory disturbances disappear. The hyperalgesia may last with diminishing severity for a few days. The tenderness of the skin and muscles in the regions described above may be found in patients during the early stages of dilatation of the heart from any cause, and is very common in heart failure secondary to mitral disease. In some cases one can tell when improvement is taking place by noting the diminution of this tenderness.

There can be little doubt as to the mechanism by which the hyperalgesia of the tissues in the three regions is brought about. The relation of the dilatation of the heart and liver with these sensory phenomena is undoubtedly that of cause and effect. The tenderness to pressure of the tissues in the left chest is due to stimulation of the afferent sympathetic nerves by the dilated heart. These nerves stimulate the sensory centres of the third and fourth thoracic nerves in the spinal cord, so that a stimulus reaching them from their peripheral distribution gives rise to a painful impression. The tenderness of the left sterno-mastoid and trapezius muscle, and of the skin of the neck, is due to the afferent fibres of the " bulbar autonomic " system—that is the vagus, conveying a stimulus to the sensory roots of the second and third cervical nerves. The

hyperalgesia of the tissues covering the liver is due to stimulation of the sensory centres in the spinal cord by the afferent sympathetic fibres from the engorged liver.

124. The Pain of Angina Pectoris is a Viscero-sensory Reflex.—The usual description given of the pain in angina pectoris is that it is felt in the heart and shoots into the arm, or that there are two pains, a local pain in the heart and a referred pain in the arm. If, however, a careful analysis be made of all the symptoms present, facts will be found that practically demonstrate that in angina pectoris there is but one kind of pain, and that its production is in accordance with the law I have attempted to establish, namely, that it is a viscero-sensory reflex. One is not able in every case to demonstrate the proofs of this hypothesis, but facts derived from suitable cases afford legitimate conclusions applicable to all cases. Shortly, these facts are, that the pain in the very gravest cases may be felt in regions distant from the heart; that this pain is identical in character with that felt over the heart; that the pain may originally start in parts distant from the heart, and gradually approach and settle over the heart; and, lastly, that the tissues of the external body wall over the heart may be found extremely hyperalgesic after the pain has passed away. From this last fact it is inferred that, inasmuch as the seat of pain corresponds to the region of hyperalgesia, therefore the pain was felt by the hyperalgesic nerves. To assume otherwise would be to ignore a principle that explains satisfactorily the sensation of pain wherever arising.

The following observations illustrate this point.

They are examples chosen from a large number of cases that demonstrate the same feature. For the sake of brevity only those points bearing upon this argument are referred to.

Female, aged 30, suffering from stenosis of the aortic, mitral, and tricuspid valves, was seized with a violent pain referred to the outer part of the chest wall. The pain passed off, but a sense of soreness and smarting remained over the part in which the pain was felt. On examining her I found a portion of the skin of the chest extremely tender to touch, corresponding to the area shaded in fig. 17.

A few days later she began to suffer from attacks of pain in the left breast and down the inside of the left arm, and on examination I found that the hyperalgesia had extended and occupied an area similar to that shaded in fig. 18.

These attacks of pain became so severe on the slightest exertion that she was obliged to keep to her bed. She partially recovered from these attacks, but they recurred with increased severity. When suffering the most severe attacks the hyperalgesia embraced nearly the whole of the left chest and inside of the left arm, and also a portion of the right chest. The left sterno-mastoid muscle and trapezius also became very tender, and the patient would sometimes complain of pain on the inner surface of the right arm, at the elbow, where also I found a patch of cutaneous hyperalgesia. Two years and a half after the first attack of pain she was recovering from a series of violent attacks, when, on getting out of bed, she fell forward and died immediately.

The fact that in this case the attacks of pain were followed by a hyperalgesia of the skin in the region where the pain was felt, and the further fact

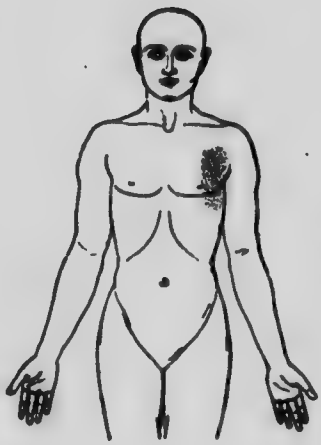


FIG. 17.

The shaded area shows the distribution of the cutaneous hyperalgesia after the first attack of angina pectoris (compare with fig. 18).

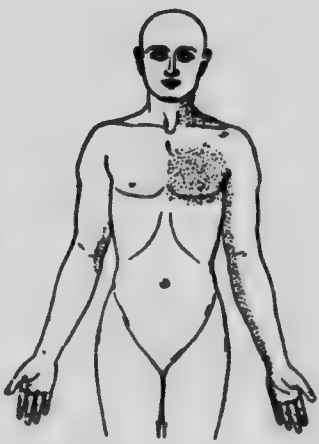


FIG. 18.

After repeated attacks of angina pectoris the pain and hyperalgesia extended to the regions shaded here. Note the areas in the neck and inner side of right elbow (compare with figs. 6 and 7).

that the pain started at a distance from the cardiac region, and was often felt most severely at a distance from the heart, proves that the cardiac pain in this case was a viscero-sensory reflex, and that the pain felt over the precordia was presumably of the same nature.

Female, aged 56, with high blood pressure, suffers from pain in the foot (gout), and has had several severe attacks of true angina pectoris, in which the pain is referred over the left chest and through to the shoulder. After the attack she passes a large quantity of clear urine, and the skin and deeper tissues of the left breast and the left sterno-mastoid and trapezius muscles become very tender on pressure. In one attack the pain was felt in a limited area over the second left interspace, and next morning I found the skin and deeper tissues at this place extremely tender to the slightest pressure.

In this instance, also, the hyperalgesia of the skin corresponded to the region where pain was felt, and is presumptive evidence in favour of the view that the pain as well as the hyperalgesia is the result of the viscero-sensory reflex.

Male, aged 42, consulted me on October 18th, 1905, complaining of pain in the left little finger and ulnar border of the left arm and forearm, coming on when he exerts himself at his work and in going up hill. For some months he suffered from a dull aching pain at the back over his shoulder blades. I found dilatation of the aorta, slight incompetence of the aortic valves, and slight enlargement of the heart (verified at the subsequent post-mortem examination). The blood pressure was 150 mm. Hg. During the following weeks the pain in the left arm

increased in severity, gradually extended up the arm till it was felt in the axilla, and finally invaded the left chest. At first the pain was wont to start at the little finger and to pass rapidly up the arm, but latterly it seized him with such severity and suddenness that he could not tell where it began. It usually held him with the greatest severity either over the heart or in the inner surface of the left arm immediately above the internal condyle. I particularly asked him to note in his frequent attacks if there was a difference between the arm pain and the chest pain, and his reply was that there was no difference in the character of the pain, but, if anything, the arm pain was the worse. Sometimes the pain was very severe up the left side of the neck and behind the left ear. Under treatment he seemed to make considerable improvement. During January, 1906, these attacks recurred. During some of them the pain was so agonising that he felt he was dying, and wished to die. The pain was equally severe in chest and arm, and saliva sometimes dribbled from his mouth. On February 12th, the least exertion was sufficient to induce a severe attack of pain, from three p.m. to seven p.m. he was scarcely free from pain, and ultimately became unconscious. When I saw him next day he was having another series of attacks. He was keeping his left arm very still, and helping himself to food entirely with his right hand. He told me he dare not move his left arm, as even the act of lifting the left hand to his mouth was sufficient to induce an attack. His pulse was extremely soft and weak. His blood pressure had fallen to 95 mm. Hg. During the following night he had another series of attacks, became unconscious and expired.

I omit many details in this case on purpose to emphasise the regions in which the pain was felt in a case of the most severe form of angina pectoris. It seems to me that no other explanation save that of the viscero-sensory reflex can satisfactorily account for the pains in this case, and to attempt to distinguish the chest pain as a heart pain and the pain in the arm as a referred pain would be arbitrary, illogical, and opposed to the evidence. The radiation of the pain from the hand to the chest was practically of the same nature as the more common radiation of the pain from the chest to the hand. The pain in the neck and behind the ear on the same hypothesis would be induced by the stimulus passing from the heart by the vagus, a view that would also explain the increased flow of saliva during some of the attacks, points to which I shall afterwards revert.

It is interesting to note here that the movement of the left arm would induce an attack of angina pectoris. I have already pointed out (page 85) that a stimulus from any source reaching an irritable focus in the cord will cause the characteristic pain to arise. In the next observation the stimulus reached the cord from the skin of the chest.

The two following observations of attacks of angina pectoris which I witnessed illustrate true heart pain of the most severe type at places remote from the heart.

Male, aged 14, suffering from adhesive mediastinitis, with enormous enlargement of the heart. The patient lay propped up in bed. As I was gently testing the sensibility of the skin outside and under the left nipple the patient was suddenly attacked with severe pain. He gave a

great sob, and leant forward with his left upper arm across his chest, and his right hand pressing it gently. He rocked backwards and forwards with deep sobs, while tears streamed down his cheeks. His pulse became very soft and his face pale, with beads of perspiration on his forehead. In a few minutes the pain subsided and he lay back exhausted. Afterwards he said that, on my touching a certain spot, a pain shot from his chest to his arm, and during the whole time the awful pain remained in his arm, and he put his hand over the fleshy part of the upper arm. His doctor told me he had given up examining him by auscultation, because on a few occasions, on applying the stethoscope, attacks similar to those I had witnessed were induced.

Female, aged 60, complained of pain of agonising severity limited to the ulnar border of the left forearm. Coming to see me one day she hurried to catch the train, and when she reached my consulting room she sat down. In a few minutes the pain seized her, and she took up her left arm and nursed it across her breast with evidences of great suffering. The pain subsided in a few moments, and she said she felt as if she would have died. The pain was felt nowhere but in the left forearm. Three months afterwards the patient died from heart failure. At the post-mortem examination there was found marked atheroma, calcification of the coronary arteries and extensive chronic fibrous myocarditis.

In this last case the pain was doubtless limited to the highest sensory nerve centre (first thoracic), whose fibres are associated with the sympathetic supply of the heart.

125. Evidences of the Viscero-motor Reflex.—So far I have dealt with the viscero-sensory reflex, and no less striking evidence can be found of the viscero-motor reflex among the group of symptoms included in the term "angina pectoris." Some would limit the term "angina pectoris" to that class of cases where, in addition to the pain, there is a sense of contraction in the chest, amounting at times to the sensation as if the chest were gripped in a vice, or as if the breast-bone would break. I am convinced that these sensations arise from spasm of the intercostal muscles, and correspond to the hard contraction of the flat abdominal muscles in affections of the abdominal viscera. If one watches a case of what is called "muscular rheumatism" where the intercostal muscles are affected, and where these muscles are stimulated by the slightest movement to violent cramp-like contractions, one cannot but be struck by the resemblance to the description given of the "gripping" sensation experienced by patients suffering from certain affections of the heart. I have watched the attacks in such cases and could find no difference between them and those where the sense of contraction was the chief symptom in heart disease. The viscero-motor reflex may be present alone, or, as is more commonly the case, it may be associated with the pain. The purely viscero-motor reflex is seen best in the elderly, where it may be considered as a symptom of one form of the terminal affections of the heart due to arterio-sclerosis or old age. I have found it a precursor of steadily advancing cardiac weakness, and although for a time considerable relief may be afforded the changes in the heart are so advanced that, in the nature of things, only one end

can be looked for. The three following observations illustrate these views.

Male, aged 82, with large tortuous arteries, was seized while walking with a sense of constriction across the chest that compelled him to stand still. These attacks became so frequent and so severe that he could scarcely walk fifty yards before he had to stop and lean against the wall. He described the sensation as one not of pain, but as if somebody gripped the upper part of the chest with a strong hand. With rest and suitable treatment these attacks gradually disappeared. Three months later the heart suddenly became irregular (nodal rhythm), dropsy set in, and he died after seven weeks of heart failure.

Male, aged 74, had suffered for several years from attacks of intermittent high blood pressure. Latterly these attacks were accompanied by a feeling of tightness across the chest when he walked. This sense of constriction disappeared after a course of potassium iodide. He suddenly died while reading his newspaper after breakfast.

Female, aged 78. Two years before her death she experienced attacks of breathlessness with a sensation of constriction across the chest. This feeling of tightness was so readily set up that she was obliged to stay in bed. The attacks disappeared, but recurred again shortly before her death. These latter attacks were accompanied by slight precordial pain. She became gradually weaker and died. At the post-mortem examination the coronary arteries were markedly thickened, with calcareous patches in their walls.

The following experience illustrates the fact that the viscero-motor reflex is a symptom distinct from the pain.

Male, aged 48, consulted me on November 25th, 1905, for a pain he felt across the middle of his chest. He had felt a slight pain here for some months on walking up a hill. He is a master-builder, and on this day, while watching his men at work, feeling cold, he began to help them to dig up some earth to warm himself. He did this for a quarter of an hour with a good deal of energy. He then examined a few partially built houses, running up and down a great many steps. On his way home he became conscious of pain in his chest, and as it continued to increase in severity he called on me. I examined him carefully, and found a slight dilatation of the heart with an impure first sound. The blood pressure was 130 mm. Hg. On his way home the pain increased in severity, and after he reached home it became very violent. My colleague saw him and prescribed opium, which relieved him. When I saw him next morning he gave a graphic account of his sufferings. He said: "In the tram coming home the pain got worse, and after getting home it became so severe that I felt I was going to die. The pain spread from my chest down my left arm to my little finger. You asked me, when I saw you yesterday, if I felt any gripping sensation, and I did not know what you meant; but, by George, I know now. When the pain was at its worst, I felt my chest suddenly seized as in a vice, and I rolled on the floor in agony. The pain and the gripping eased off for a time and then came on again. This continued till I got the opium. This morning I awoke all right, but at 10.30 that gripping sensation came on and held me tight for ten minutes. I dare not move for fear the awful pain should come on, and I felt every moment it

was about to come, and I was in such terror of it that the sweat poured off me."

With rest and treatment these attacks grew less, till now he only feels a slight pain when he over-exerts himself.

So far the symptoms I have dealt with have been mainly concerned with the reflexes connected with the sympathetic nerve supply. Equally instructive symptoms, though less frequent, can be shown to arise from stimulation of the vagus. At its centre in the medulla this nerve is in near relationship to the upper cervical nerves, and, it would seem, more particularly the sensory nerves supplying the sterno-mastoid and trapezius muscles. Not only may these muscles become extremely tender in various heart affections, but the pain from heart affections may be felt in the region of distribution of the cervical nerves, as already noted. The following observations also show the same thing.

A man, aged 62, complained of great pain striking into his chest and behind his ears when walking. Thus, in going to his work, he allowed seven or eight minutes to walk to the station, but now it took him over half an hour, as he had to stop on account of the pain every fifty yards. After accurately noting the pain he described it as arising in the left breast, extending across to the right breast, seizing him in the neck, and extending up behind the ears, where it held him with great severity. In showing me the situation, he laid the fingers of both hands over the insertion of the sterno-mastoid muscle into the mastoid process. On one occasion the pain extended from the breasts to the armpits, and down the side of each arm to the elbow.

This patient dropped dead while at his work,

and on post-mortem examination I found extreme calcareous degeneration of the coronary arteries.

126. Organic Reflexes occurring during an Attack of Angina Pectoris.—Other very striking phenomena are sometimes met with during an attack of angina pectoris. During or after an attack an abundant flow of saliva and the secretion of large quantities of pale urine may occur; both symptoms I suggest are due to reflex stimulation of nuclei on the floor of the fourth ventricle. Possibly the polyuria may be of the same character as that in diabetes insipidus, which, as is well known, may be induced in animals by puncture of the fourth ventricle.

A man, aged 58, of gouty diathesis, complained of pain, induced by the slightest exertion, which arose in the left breast, passed up the armpit, and extended down the inner surface of the left arm to the little finger. During an attack an abundant flow of saliva took place into the left side of the mouth. These attacks became so frequent that he could only walk a very short distance without inducing an attack. He died while sitting at his desk, and at the post-mortem examination I found that the heart had ruptured, and the coronary artery was very atheromatous. Where the rupture had taken place the myocardium had nearly disappeared.

Male, aged 46, whose work entails periods of great muscular exertion, complains of pain striking into the chest when walking up a hill. If he stops as soon as he feels the pain coming on, it passes off, but if he persists the pain increases to an agonising severity and radiates into both arms, but worse into the left, as far down as the

little finger. At the same time the chest is gripped, so that he is forced to straighten himself and to breathe deeply, and at the same time his mouth fills with saliva, and an aching pain is felt in the throat. A few minutes after each attack he has to pass urine, which is always abundant and very clear. These details I had from him after he had carefully noted a number of attacks.

127. Summation of Stimuli as a Cause of Angina Pectoris.—The fundamental functions of the heart muscle correspond to those of other involuntary muscles that form the walls of hollow organs; these functions being modified to suit its special work. Like the other viscera the heart is insensitive when stimulated in a manner that provokes pain when applied to the tissues of the external body wall. I may point out that a long strong contraction of a hollow organ can produce pain, and that this is undoubtedly the cause of the severe pain associated with renal calculus, gall-stones, spasm of the bowel, and uterine contractions. Can the heart give rise to pain in a similar manner? On account of the modification of its functions, the heart cannot pass into a prolonged state of contraction. Immediately it contracts, the function of contractility is abolished and the muscle passes at once into a state of relaxation, and for this reason the pain cannot be produced by a "spasm of the heart." But I suggest that the heart muscle may produce pain when it is confronted with work greater than it can readily overcome, a condition which produces strong peristalsis and pain in other hollow viscera. But the pain in the heart arises by a slightly different mechanism. Skeletal muscle will contract in obedience to stimulation of a sensory nerve going

to the spinal centre of its nerve, if a stimulus of sufficient strength be applied. If the stimulus be too weak, no contraction follows, but if this weak stimulus be frequently and rapidly repeated, then the muscle contracts in accordance with the law of the summation of stimuli. I suggest that the heart muscle induces pain on the principle of summation of stimuli. If we minutely study our cases we shall find that the pain rarely arises at the first exposure of the heart to the effort that induces the pain. Sometimes effort has been undertaken a few minutes before the pain comes on, and in certain cases it may not come on for hours after the causal exertion has ceased.

From such observations we can infer that the heart muscle was exhausted by the exertion, and so great was the exhaustion of the reserve force that the heart was unable to regain its reserve on cessation of effort; thus the exhaustion persisted till it culminated in an attack of angina pectoris.

CHAPTER XXI.

ESTIMATION OF THE VALUE OF SYMPTOMS.

128. *The Relation of the Symptoms to the General State.*
129. *Remote Effects of the Lesion.*
130. *Relation of Symptoms arising from different Causes.*
131. *The Bearing of Symptoms on Prognosis.*
132. *The Bearing of Symptoms on Treatment.*

In this chapter I endeavour to sum up the general principles which have been applied in more detail in the earlier chapters. That the interpretation of symptoms should be imperfect can readily be recognised, for not only is the subject too vast to be dealt with in a few pages, but the knowledge to deal with it efficiently is lacking. I confine myself, therefore, to a few general principles that have been of service to me in my endeavours to estimate the value of symptoms in individual cases.

128. The Relation of the Symptoms to the General State.—Before a final opinion is formed of the value of any symptom, the physician must consider the patient as a whole, and the relation of any abnormal sign to the general health. The patient's complaint may be of a trivial nature, and

the examination of the different organs may reveal no abnormality; nevertheless the contemplation of the patient's whole economy may help one not to dismiss the symptoms too hastily because of their seeming triviality. Malignant disease of the stomach may cause the symptoms of a simple indigestion, but a slight loss in weight and a slight change in the patient's colour may ultimately be found to indicate the grave nature of the illness. The description of the patient's complaint may be given in such terms that the physician may fancy it is exaggerated and due to the patient being of a neurotic habit. This may be true, yet the complaint from which the patient suffers may have so undermined his strength that the neurotic habit has been induced by his prolonged suffering. It is necessary to state this because the presence of many reflex phenomena is apt to be pooh-poohed, because of the manifest hypersensitiveness of the patient's nervous system. There is no doubt that in people of a neurotic habit there is a greater tendency for reflex phenomena to be readily produced, yet the phemonena should not on that account be ignored, but should be utilised for the purpose of discovering the lesion if possible, and the neurotic tendency being duly discounted, their true value should be estimated. However widespread such symptoms as pain and hyperalgesia may be, there is always some irritation in the cord, induced, as a rule, by some trouble in the viscera or external body wall. This was well illustrated in the following case, which was under my observation for many years. I attended the patient during several attacks of rheumatic fever from 1880 to 1884. She developed well-marked symptoms

of aortic, mitral, and tricuspid valvular disease, and was for years very short of breath occasionally, but had no pain nor hyperalgesia. In 1895 she began to complain of pain, particularly after meals, referred to the lower part of the epigastric region, with a limited area of hyperalgesia. The pain became very severe, so that I came to the opinion that she had a gastric ulcer near the pyloric orifice. The hyperalgesia spread widely round to the left chest. She kept in bed for a few weeks, but began to go about her household duties before the pain and hyperalgesia had disappeared. She then began to have attacks of pain in the chest on exertion, slight at first, but gradually becoming more severe, until they resembled in every respect attacks of angina pectoris. Coincident with the pain, hyperalgesia appeared in the chest and arm. The distribution of this hyperalgesia, due manifestly to the heart lesion, coalesced with that due to the gastric ulcer, so that there was an extensive field of hyperalgesia embracing the left chest and abdomen, from the level of the second rib to below the umbilicus. At the patient's death there were found the lesions of the three valves mentioned, and an ulcer at the pyloric orifice. Anyone seeing the patient after the development of the extreme field of hyperalgesia might have attributed the whole condition to some such vague complaint as "neurasthenia," particularly if the nature of the cardiac lesions were not detected. I have seen another case with very severe attacks of angina pectoris and widespread hyperalgesia where no cardiac abnormality could be detected. The extraordinary acuteness and extent of the sensory phenomena might have led to the surmise that there was only a neurasthenic condition,

yet at the post-mortem examination the coronary artery was found almost impermeable, and the muscle of the heart greatly degenerated. The rule I make in these cases is to recognise the fact that, however exaggerated the reflex symptoms, and however neurotic the patient may be, the symptoms are nevertheless due to actual affection of some viscus, and a careful consideration of all the other features of the case will lead one to an approximately correct estimation of the value of the symptoms.

129. Remote Effects of the Lesion.—Not only may the continuance of a visceral lesion and prolongation of suffering lead to the exhaustion of the patient's nervous system (which is probably the reason for the ease with which the reflex phenomena are produced in many people), but the original ailment, in consequence of persistent suffering, may alter the whole mental balance of the patient. Previous to an illness he may be sensible, unselfish, and considerate of his relatives and dependents, but during illness he may become utterly selfish, wear out the patience of his children and dependents with his peevishness and want of consideration, in order that his own requirements and comforts may be satisfied. Patients in this condition are extremely difficult subjects for diagnosis, for it is to their interest to magnify their complaints, and it is difficult to estimate the value of their symptoms. This is particularly the case if one searches for hyperalgesia of skin or muscle, for they readily complain of pain and tenderness. To discriminate the symptoms in such people the distribution of the sensory phenomena (pain and hyperalgesia) affords a very good guide. Thus if one tests for hyperalgesia of a heart affection, and the symptoms are found to

extend up the chest and over the clavicle, one might reject the symptoms, for the skin over the clavicle as low as the second rib is supplied by the fourth cervical nerve, while below it is supplied by the second thoracic, so that the extension of the hyperalgesia from the second thoracic to the fourth cervical is not conceivable, nor have I ever found it to occur. So it is in other complaints; the peculiar distribution of the sensory phenomena in affections of any given organ being unknown to the patient, one can test his reliability by noting the distribution of his pain and hyperalgesia.

This method of discrimination is also to be used in distinguishing true visceral sensory phenomena in cases of suspected hysteria and malingering. If the symptoms are found to follow the distribution peculiar to one organ, even if the patient be evidently hysterical, then it may be concluded that there is an affection of the viscus, and it remains to make careful consideration of the other factors in the diagnosis in order to estimate what value the symptoms possess.

The intensification of reflex phenomena is particularly noticeable where the conditions of living have reduced the bodily strength, through worry, sleeplessness, or improper nourishment. I have been particularly struck, for instance, with the symptoms of angina pectoris that may be induced in young people who have had a long and trying period of strain. Women who work hard for their living, or who look after household duties during the day, and have to attend an invalid parent or ailing child during the night, who are frequently disturbed in sleep, or who pass the greater part of the night in constant attendance, become gradually exhausted,

and the struggle may go on until an attack of pain in the chest imperatively calls attention to the exhausted heart. In such people the attacks of angina pectoris may be extremely severe, and the hyperalgesia may be widespread, affecting both sides of the chest (the left breast particularly often becoming extremely tender), and, it may be, the neck, particularly the left sterno-mastoid and trapezius muscles.

In estimating the value of the symptoms in such cases the history of the patient's life gives an indication, and one can then recognise, with assurance, the condition of the heart that has provoked these manifestations.

Similar exaggerated symptoms, having a peculiar distribution, may arise should any other organ be affected; as in stomach affections, a slight indigestion may give rise to such symptoms as to make it difficult to tell whether some more serious condition, as gastric ulcer, may not be present.

In doubtful cases one feature when present may be taken as a rule to distinguish an affection of an organ from some general nervous manifestation, that is the viscero-motor reflex. Unfortunately this symptom is practically limited to affections of the abdominal organs, and needs to be sought for with care, lest a too susceptible superficial reflex be started. But when detected it may be looked upon as demonstrating the presence of some visceral trouble.

130. Relation of Symptoms arising from different Causes.—When a patient presents himself one may be able, on physical examination, to detect some abnormal condition to which one can refer with certainty the cause of the patient's suffering.

It may happen, however, that we detect an abnormality having no direct bearing upon the complaint of the patient, and in the absence of one having such a direct bearing, there is too often a tendency to refer the patient's complaint to the presence of the recognisable abnormality. There is no doubt that symptoms may be provoked by lesions remote from the place where the symptoms are experienced, as in referred pain, and there is no doubt that many other symptoms may be produced by lesions of remote organs, as in the widespread effects of kidney disease. But keeping all this in view, there is still need of a wise discretion in estimating the influence of lesions in which there is no recognisable connection with the symptoms. Thus epileptic attacks may be brought on by affections of the heart as in heart-block (Adams-Stokes syndrome), where the left ventricle becomes so slow in its action that the brain does not receive a sufficient supply of blood. In consequence of this anæmia the patient may faint or have an epileptic seizure. The well-recognised connection between a heart abnormality and an epileptic attack in this particular instance has led to the assumption that, if a patient has epilepsy, and at the same time has some affection of the heart such as irregular action, there is a connection between the two. Under such circumstances it is necessary to recognise the nature of the irregularity, and as it is now possible to demonstrate with precision the different forms of heart irregularity, the recognition of the particular form of irregular heart action at once permits of determining the probabilities of the heart being the cause of the epileptic attack in any given condition. Irregular action of the heart being so common, the occurrence

of epilepsy is in the majority of cases due to an independent affection, and there is no causal relation necessarily present between the two conditions.

I have already referred to errors arising from attributing the cause of symptoms to some demonstrable structural affection, which may be merely coincident or independent.

It is impossible to lay down rules applicable to all cases, and I write this in order that the subject should in every case receive consideration, since the recognition of the possibility of error may prevent the error being made.

131. The Bearing of Symptoms on Prognosis.—Of all branches of medicine there is none which has received so little real consideration as the matter of prognosis. The subject itself is one which has to be considered in nearly every case that comes under the notice of a medical man. Its importance is appreciated in all stages of life, and the just consideration of the meaning of symptoms is of cardinal importance in regard to the patient's future.

In addition to recognising the meaning of any abnormal sign or symptom, we should endeavour to acquire a knowledge of what bearing it has upon the future history of the patient. This knowledge can only be obtained by watching how patients exhibiting the abnormality withstand the storm and stress of life. This should be a special object of every general practitioner, for it is he who has the opportunity of watching individual cases over a long period of years, and of estimating the bearing of any abnormality on the patient's future life.

Sometimes our profession as a body does not sufficiently recognise its responsibility in regard

to prognosis. When an individual submits himself for an opinion he does so with such implicit confidence that the verdict given may alter the whole tenor of his life. He may, for instance, be seeking to enter some profession, when a preliminary medical examination reveals what the medical man takes to be an abnormality. An imperfect knowledge of its nature may, and unfortunately often does, lead to its being regarded as presaging possibly grave consequences, and the candidate is rejected. He is thus shut off from the prospect of his chosen calling, and, knowing the reason of his rejection, passes through life uneasily apprehensive of some impending disaster, whilst all the time the supposed abnormality may be a sign of little or no consequence.

If we look at an insurance form we realise the hardships to which applicants are exposed. "Is the pulse regular?" "Are the sounds of the heart pure?" "Is the urine free from albumen?" If such questions are answered in the negative the applicant is either rejected or is penalised for life by having to pay a higher premium, and, in addition, he is burdened with the consciousness of infirmity.

I dwell on this matter with some insistence, because I have known of so many instances in which gross injustice has been done to individuals, not only from a pecuniary aspect, but in having imposed upon them great expense, unnecessary treatment, and mental disquiet, because the meaning and prognostic significance of some simple symptom had not been recognised.

A serious responsibility is thrown upon every practitioner at times in advising upon other questions. Should a man give up his business? is a question

upon which advice is constantly sought, and whether the individual be a statesman or a labourer the greatest care is necessary in formulating the answer. Should a woman with some heart affection marry, or, if she be pregnant, should the pregnancy be allowed to proceed ? are problems that every general practitioner at one time or another will have to meet ; and if he seeks for guidance in the text-books, he finds merely general views which he cannot apply to the individual case. This fact alone should arrest the attention of the profession, and make it conscious how inefficient are the indications for an intelligent prognosis.

In estimating the value of any abnormal sign, or in determining the condition of the patient, a clear idea must be obtained of the mechanism by which any given symptom is produced, and of the effects that the underlying lesion has upon the economy. It is impossible to give here indications that would be of value, partly because the subject traverses the whole field of clinical medicine, and partly because I am not competent to deal with the matter, being only impressed with the importance of the subject and the necessity for its further consideration. So far as my experience goes, I can only say that one should never base a prognosis upon the presence of a single symptom, but should carefully investigate the effect of any abnormal sign upon the economy as a whole. The presence of albumen in the urine is often a sign of very great import. In many cases it is a sign of great gravity, and this being recognised, it is too often regarded as being invariably a serious matter. It is now recognised that its significance depends on the conditions inducing it, and it may appear when

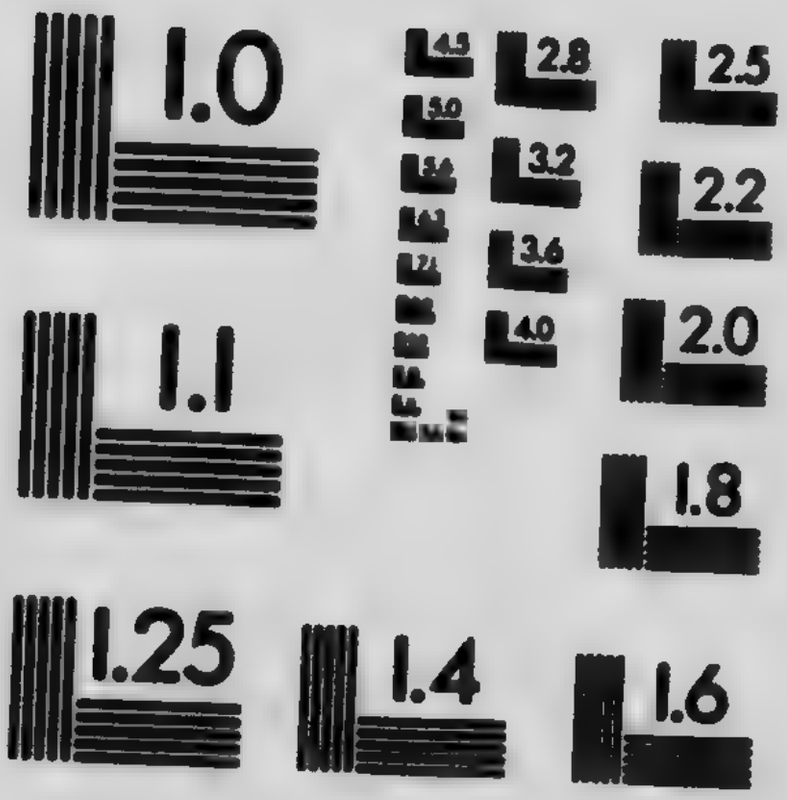
there is no serious affection of the kidney, or when the kidney affection is of such a nature that it may have little effect upon the system. Cases of albuminuria should not therefore be hastily condemned until a complete review of the whole circumstances of the case, such as the history of the illness, the condition of the other constituents in the urine and their effect upon the circulatory system, has been made. In the same way the presence of a cardiac murmur or irregularity, or even an attack of angina pectoris, should never be considered as affording grounds for a grave prognosis until the whole circumstances of the case are taken into consideration. I mention these instances merely as indications as to what course to pursue when doubts arise as to the significance of any abnormal sign.

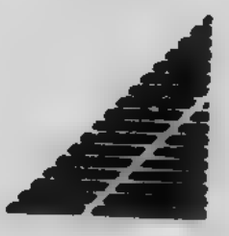
The symptoms which arise reflexly in like manner have to be carefully weighed. Intensity of suffering may have no relation to the gravity of the complaint. Toothache causes no anxiety as to the prognosis, though the immediate suffering is severe. Were the cause of the pain not so easily recognised the agonising distress would at times be viewed with the gravest anxiety. Extreme suffering from some trivial disease may be found among the symptoms of many organs. When it is recognised that the most agonising pains are associated with the contraction of non-striped muscular fibres, it will be realised that the cause inducing a contraction capable of calling forth violent pain may be of the most varied kinds, trivial as well as important. Even in the matter of angina pectoris the violence of the pain bears no necessary relation to the gravity of the heart complaint. In many cases the only sensation brought on by exhaustion of the heart



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muscle may be limited to a mere sense of constriction, and this, if properly appreciated, may indeed be the one sign which calls attention to the serious condition of the heart. I have repeatedly been consulted by elderly people for this sense of constriction across the chest when they exerted themselves, and in many cases it was the earliest symptom that heralded the termination of the patient's life. On the other hand, some of the most violent attacks of angina pectoris have occurred in people in whom the exhaustion of the heart was but temporary, and the restoration of reserve force resulted in a complete cessation of pain and in permanent recovery. Between these extremes there are many intermediate forms, and it needs a careful inquiry into all the circumstances before a definite prognosis can be given.

In regard to the reflex phenomena the tendency to the exaggeration of symptoms by people with a hypersensitive nervous system must always be borne in mind.

132. The Bearing of Symptoms on Treatment.—The due appreciation of the mechanism by which symptoms are produced has a profound influence on treatment. It is often stated that treatment has to be symptomatic, that is, the symptoms are to be treated because the nature of the affection inducing those symptoms cannot be detected. Whole systems of treatment are based upon this idea, and though at times we may be forced to accept this line, it should always be done with regret at our incapacity to recognise the underlying cause of the suffering. A constant endeavour to make out the meaning of these symptoms, which have perforce to be treated without knowledge of their cause, will gradually

diminish the number of patients who have to be treated symptomatically.

As pain is the most common complaint from which so many suffer, its relief is an aim of our treatment. But it should never be supposed that the assuagement of pain is the only object. It has become stereotyped to say "remove the cause," and if this advice had not become so much of a platitude more attention might be given to the "search for the cause." The recognition of the cause can only be attained in the majority of sufferers by a recognition of the mechanism by which the suffering is produced. Recognising, for instance, that contraction of non-striped muscle produces a referred pain, the knowledge of how the pain is produced leads to the recognition of the hollow viscus producing it. There must be an abnormal stimulus exciting the muscle to contraction, and experience leads us to conclude what is the most common cause likely to produce the stimulation in a particular viscus. A pain with accompanying phenomena located in a certain region informs us that the stimulus arises from the gall duct or the ureter. Experience tells us that gall-stones or renal calculus is the most frequent cause. The absence of symptoms indicative of any other lesion confirms this view. On recognising that this is the cause the question arises, Can we remove it? In the vast majority of cases this is only possible by surgical operation, and the question of the propriety of this procedure has to be considered. If, as is often the case, this proves unadvisable, then the treatment must proceed on other lines, and the recognition of the mechanism by which the pain arises again gives indications. As it is manifestly due to the strong contraction of

non-striped muscle, measures that will relax the contraction of the muscle will naturally be the remedy in this particular case.

On the other hand, if the pain be aroused by some hollow muscular organ, where it is possible by simple means to remove the cause that stimulates the contraction, to this end treatment should be primarily directed. If, for instance, the indications point to the pain arising from painful peristalsis of the bowel, the inquiry will proceed to find out the probable nature of the stimulus. If there has been a history of constipation, or incomplete evacuation of the bowel, the retention of scybalous masses is suggested as the cause of the peristalsis, and the treatment will be guided to measures that will lead to evacuation. So also with regard to any other viscus that can be emptied, the recognition of the nature of the symptoms affording the best guide for a rational and effective treatment.

In an organ such as the heart, that cannot have the cause of the suffering removed by some mechanical process, the consideration of the conditions that induce the symptoms leads to a rational guide in treatment. As I have pointed out, any symptom of suffering points to an exhaustion of the reserve force, whatever be the nature of the functional exhaustion or structural lesion. The recognition of this indicates that treatment in the first instance must be directed to the restoration of this reserve force, and this can be done when consideration of the factors inducing the exhaustion are appreciated, such as over-work, worry, sleeplessness, or the hampering effect of some organic lesion. This demands careful investigation into the special features of each individual case.

These remarks may seem so evident as to be altogether unnecessary, as everyone recognises them. But though as a matter of theory they are the commonest of platitudes, as a matter of practice they are often neglected. If we consider the matter in relation to the treatment of heart affections, for instance, it will be found that, whatever the nature of the heart failure, a routine method of treatment is, with few exceptions, invariably adopted. Thus heart failure is supposed to demand what are called "heart tonics," and the usual treatment is to prescribe the tonic which is dictated by the fancy of the physician or by the fashion of the day. In our inquiries into systems of treatment, such as are elaborated at places like Nauheim, it will be found that routine methods are employed, after few or no discriminating inquiries into the peculiar features of each case. One could indefinitely extend illustrations, drawn from other systems, where rule of thumb treatment is followed, to the neglect of the simple and obvious methods suggested by the careful appreciation of the meaning of symptoms.

I have already pointed out that treatment may be a factor in diagnosis—so-called diagnosis "ex juvantibus"—the manner in which symptoms react to treatment being often a useful help, as, for instance, the use of mercury or iodide of potassium in suspected cases of syphilis. But it is necessary also to appreciate when possible the manner in which the treatment acts. It must be the experience of everyone who has seen a large number of cases of stomach affections, that many cases of great suffering, where there is a manifest structural lesion, obtain relief by some simple remedy or change in

diet. Thus in pyloric stenosis with dilatation of the stomach the patient may have suffered for a long period, and some simple remedy, as bicarbonate of soda, may give instant relief and freedom from suffering for a long time. So also a change in the diet may have the same result. Too often such remarkable experiences are mistaken by physician and patient as evidences of the curative value and potency of the drug or system of diet, and so we get the exaggerated praises of different drugs and systems, so common nowadays. If it be recognised that some constituent was present in the stomach which occasioned the sufferings of the patient, and that the drug had neutralised its effects, or the change of diet had prevented its formation, it would have led to a true appreciation of the benefits obtained by the treatment. It cannot be too strongly insisted upon that the reflex symptoms, which are those that are thus "cured," may arise, not from the actual lesion, but from a susceptibility to stimulation, or from some agent capable of inducing an adequate stimulation, and that the symptoms give no clue to the nature of the stimulation or to the agent causing it.

The recognition of the meaning of the reflex phenomena is of much use in so many ways that it is scarcely possible to do more than indicate certain phases of their value. The muscular contractions and hyperalgesia are always indications that some active process is going on. In cases of gastric ulcer, for instance, the treatment may have been so successful that the patient's sufferings are relieved and a "cure" is said to have resulted. But a careful examination of the left rectus muscle may reveal tenderness of its upper division with increased tone;

and these symptoms indicate that the stomach lesion is still so active that it keeps up an irritable focus in the cord, and give indication that the treatment should be continued if a permanent recovery is to be attained. Occasionally one meets with cases where this viscero-motor reflex has been recognised and taken as the factor needing treatment. In gall-stone disease, when there is present the tell-tale sign of contracted muscles in the epigastrium, energetic means, as baths, electricity, massage, are frequently employed to reduce the "hardness" of the belly wall!

The conception of the nature of the reflex phenomena may give a more direct aim to our therapeutic endeavours. I have already pointed out how the suffering in stomach affections may be due to the accidental presence of an agent that is capable of producing pain, and that remedies may neutralise the effect of the agent without modifying the disease process. It is conceivable that an effect may be produced in other ways, whereby treatment may influence the reflex symptoms at some portion of the chain between the lesion and the mental conception of the suffering. Thus a drug may act upon the muscular spasm when it causes pain, or it may act upon the spinal cord at the level where the visceral nerve stimulates the sensory nerve. It is just possible that it is here the relief is obtained in certain forms of counter irritation. Thus I have seen a patient with a pyloric ulcer of the stomach obtain relief by a blister on the epigastrium over the limited area in which the pain was felt. This blister did not directly affect the ulcer, because the ulcer did not lie at the same level (*see* fig. 11). Nor could one imagine that any reflex effect was produced in the

ulcer itself. It seems more probable that the stimulus from the skin affecting directly the peripheral distribution of the sensory nerve prevented by some inhibiting process the stimulus from the viscus passing to the sensory cells in the spinal cord. This seems the more reasonable, because it was found that on the healing of the blister the old pain from the ulcer returned, but if the blistered skin were kept raw by the application of some ointment the pain from the ulcer was subdued. This view receives support from the result of recent researches of Sherrington, where it has been shown that nerve paths may be stimulated from a variety of sources, but that of several contemporaneous stimuli one stimulus may be received and the others inhibited.

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